US011788274B2

(12) **United States Patent**
Espinosa

(10) **Patent No.: US 11,788,274 B2**
(45) **Date of Patent: Oct. 17, 2023**

(54) **COMPRESSION AND TENSION REINFORCED WALL**

(71) Applicant: **CETRES HOLDINGS, LLC**, Jackson, WY (US)

(72) Inventor: **Thomas M. Espinosa**, Snohomish, WA (US)

(73) Assignee: **CETRES HOLDINGS, LLC**, Jackson, WY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/882,832**

(22) Filed: **Aug. 8, 2022**

(65) **Prior Publication Data**

US 2023/0064212 A1 Mar. 2, 2023

Related U.S. Application Data

(62) Division of application No. 16/415,595, filed on May 17, 2019, now Pat. No. 11,603,656.

(60) Provisional application No. 62/672,809, filed on May 17, 2018.

(51) **Int. Cl.**

E04B 1/41	(2006.01)
E04B 1/26	(2006.01)
E04C 5/16	(2006.01)
E04B 2/56	(2006.01)

(52) **U.S. Cl.**

CPC ***E04B 1/4157*** (2013.01); ***E04B 1/2604*** (2013.01); ***E04B 2/56*** (2013.01); ***E04C 5/16*** (2013.01); *E04B 2001/268* (2013.01)

(58) **Field of Classification Search**

CPC E04B 1/4517; E04B 1/2604; E04B 2/56; E04B 2001/268; E04C 5/16

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,782,061	A	1/1974	Minutoli
4,812,096	A	3/1989	Peterson
4,875,314	A	10/1989	Boilen
7,971,411	B2	7/2011	Commins

(Continued)

FOREIGN PATENT DOCUMENTS

EP	328205	A1	2/2018
WO	WO 2008/033357	A2	3/2008

OTHER PUBLICATIONS

Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for PCT/US19/32918.

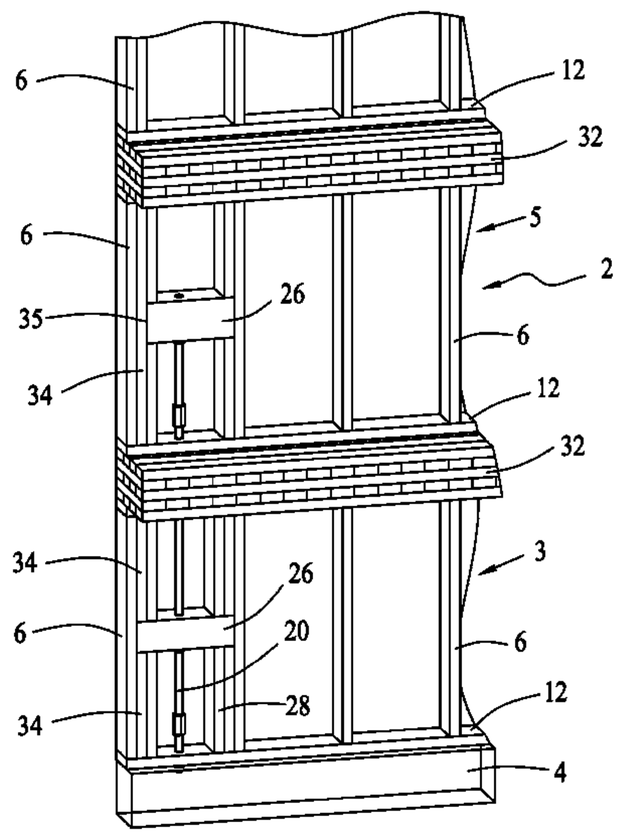
(Continued)

Primary Examiner — Beth A Stephan
(74) *Attorney, Agent, or Firm* — FRESH IP PLC

(57) **ABSTRACT**

A reinforced building wall includes a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a horizontal first bridge member disposed between the first stud and the second stud, the first bridge member having a first vertical opening; a rod post having one end operably connected to the anchor rod and operably connected to the first bridge member to transfer downward forces from the first bridge member and the second bridge member to the rod post; the anchor rod is attached to an anchor; and the anchor is disposed in an upper portion of the foundation.

18 Claims, 155 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

8,689,518	B2	4/2014	Gridley
8,943,777	B2	2/2015	Espinosa
9,097,000	B2	8/2015	Espinosa
9,874,009	B2	1/2018	Espinosa
2006/0265274	A1	11/2006	Commins
2010/0115866	A1	5/2010	Espinosa
2012/0304589	A1	12/2012	Commins
2014/0123574	A1	5/2014	Paone et al.
2014/0260067	A1	9/2014	Pryor
2016/0244960	A1	8/2016	Espinosa
2017/0089063	A1	3/2017	Espinosa

OTHER PUBLICATIONS

Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration of PCT/US19/32918.

European Search Report and Opinion for European Patent Application No. 19803514.9 dated May 19, 2021.

FIG. 1

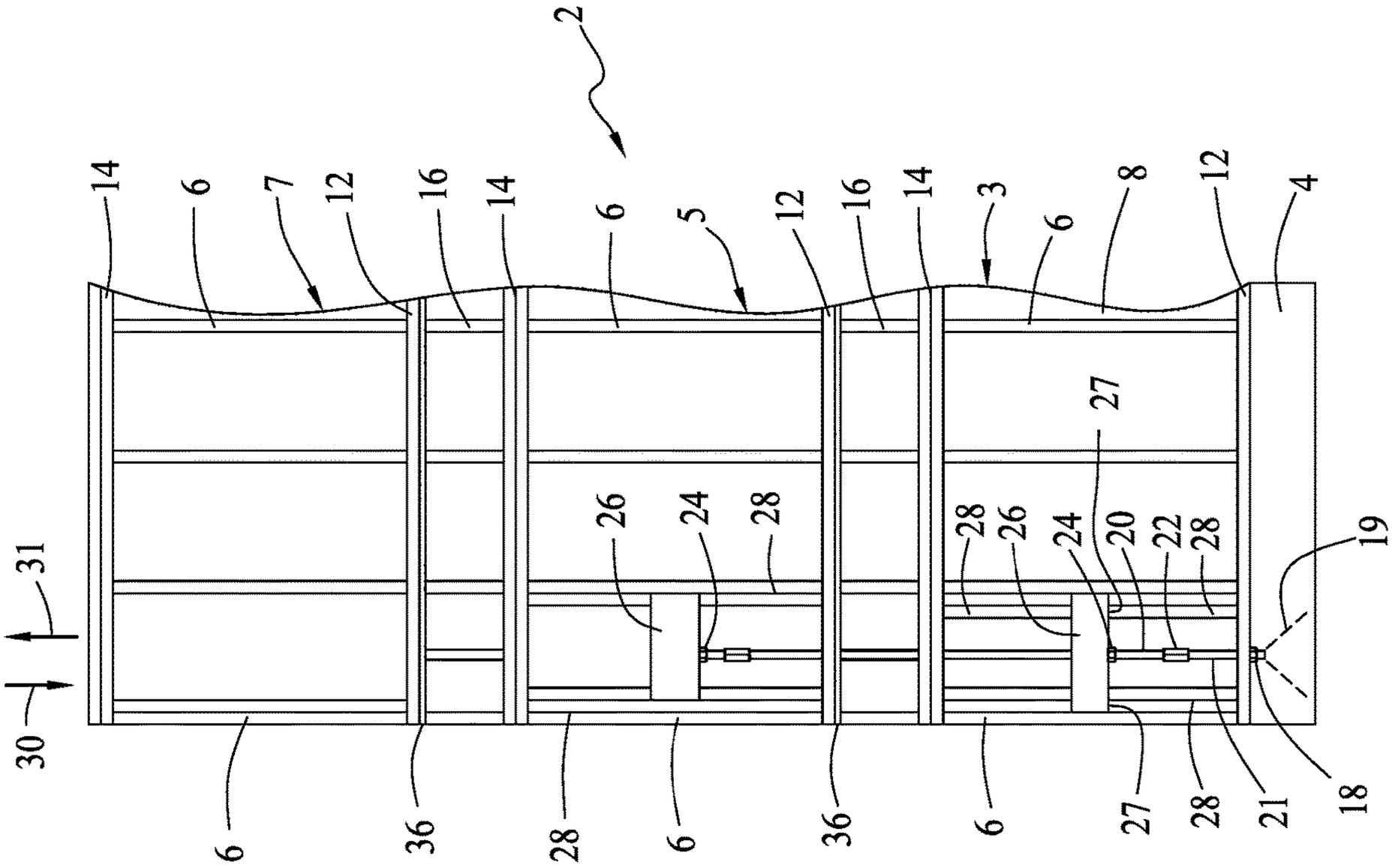

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FIG. 2

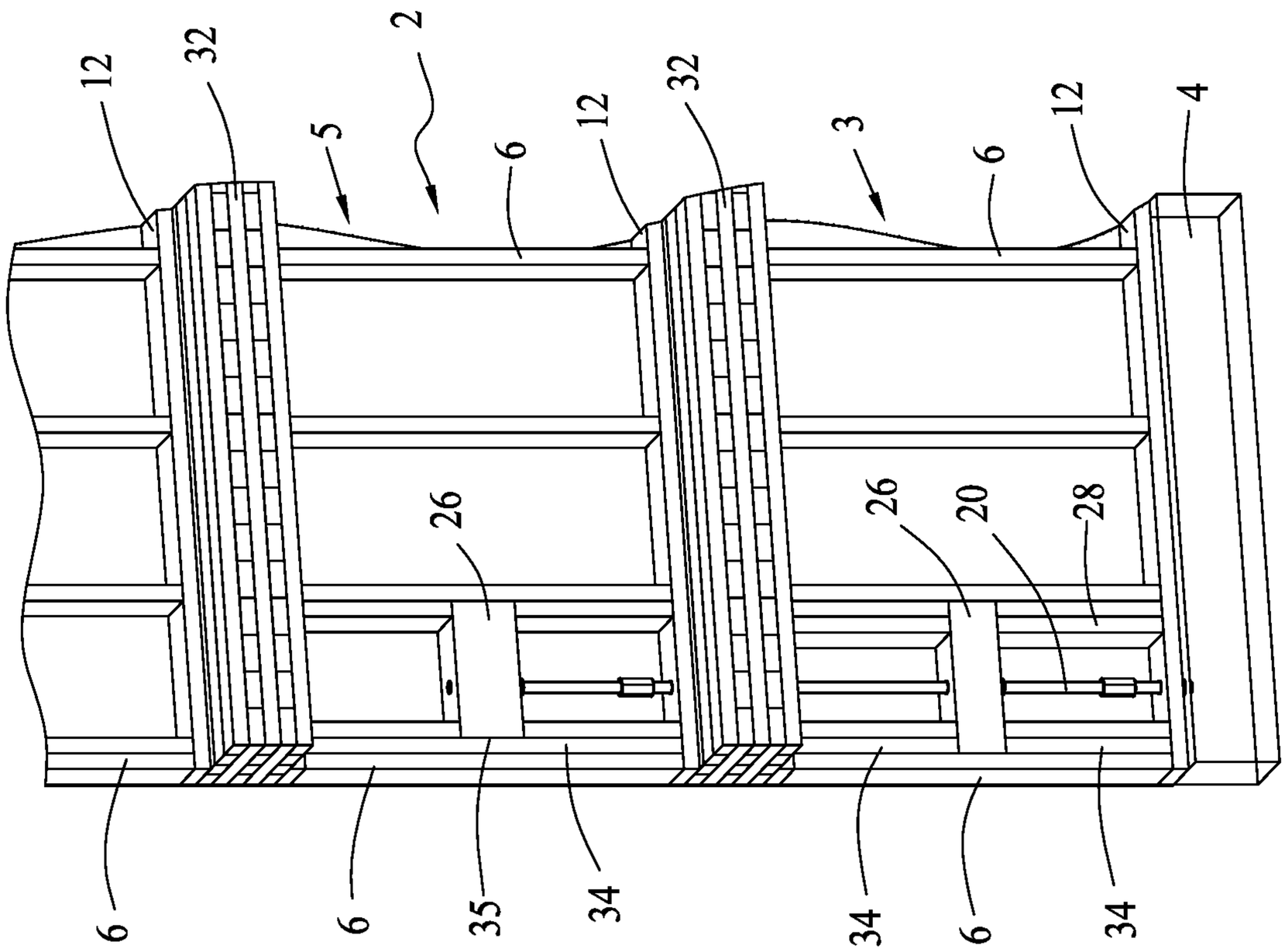
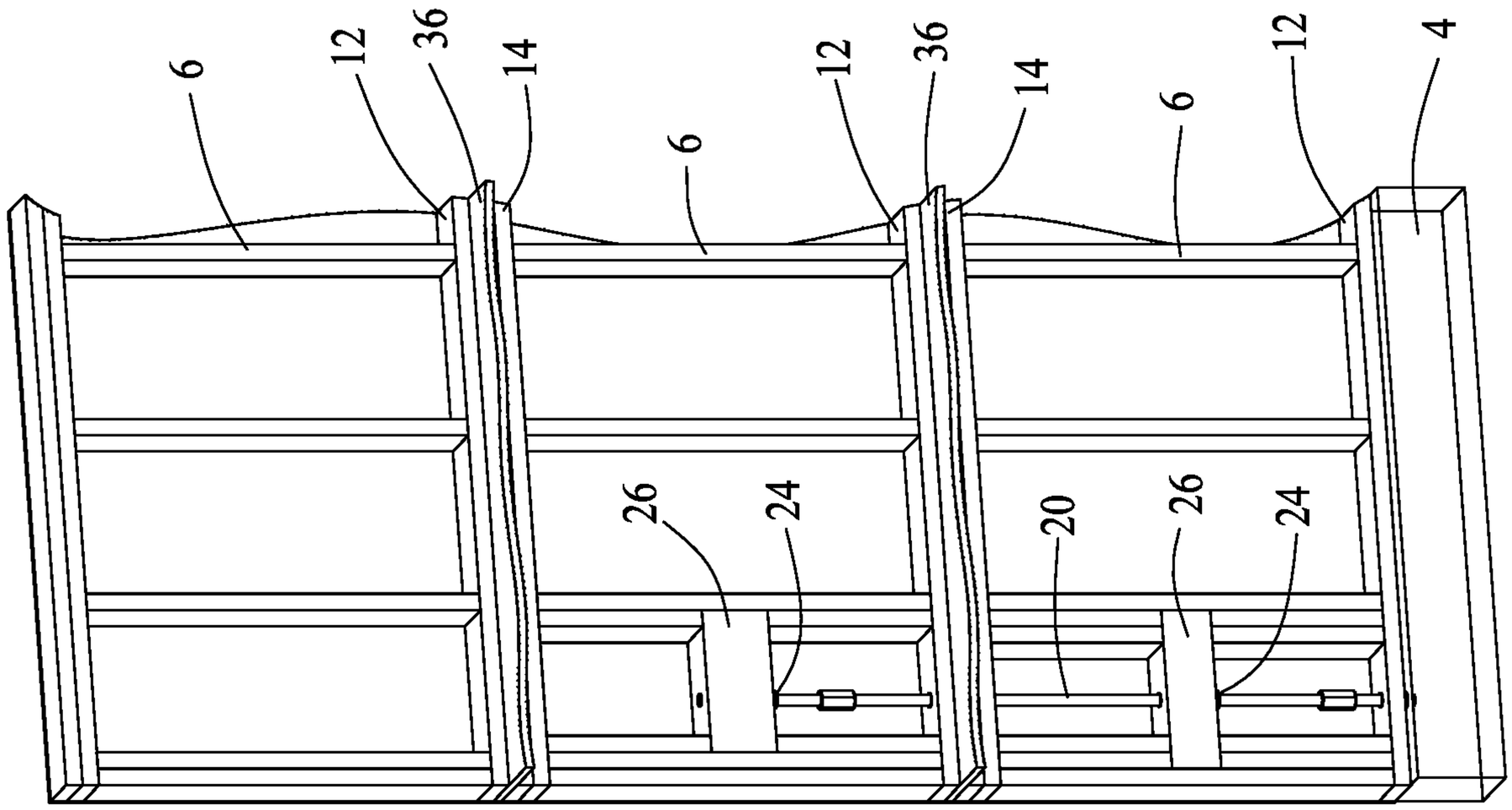
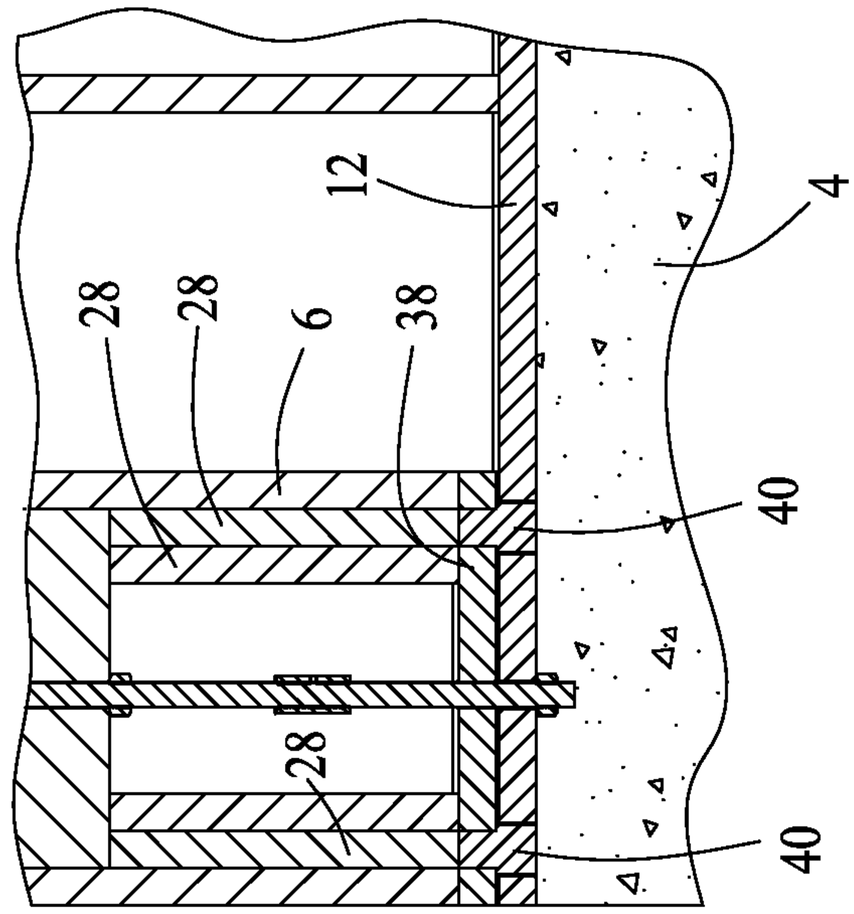


FIG. 3





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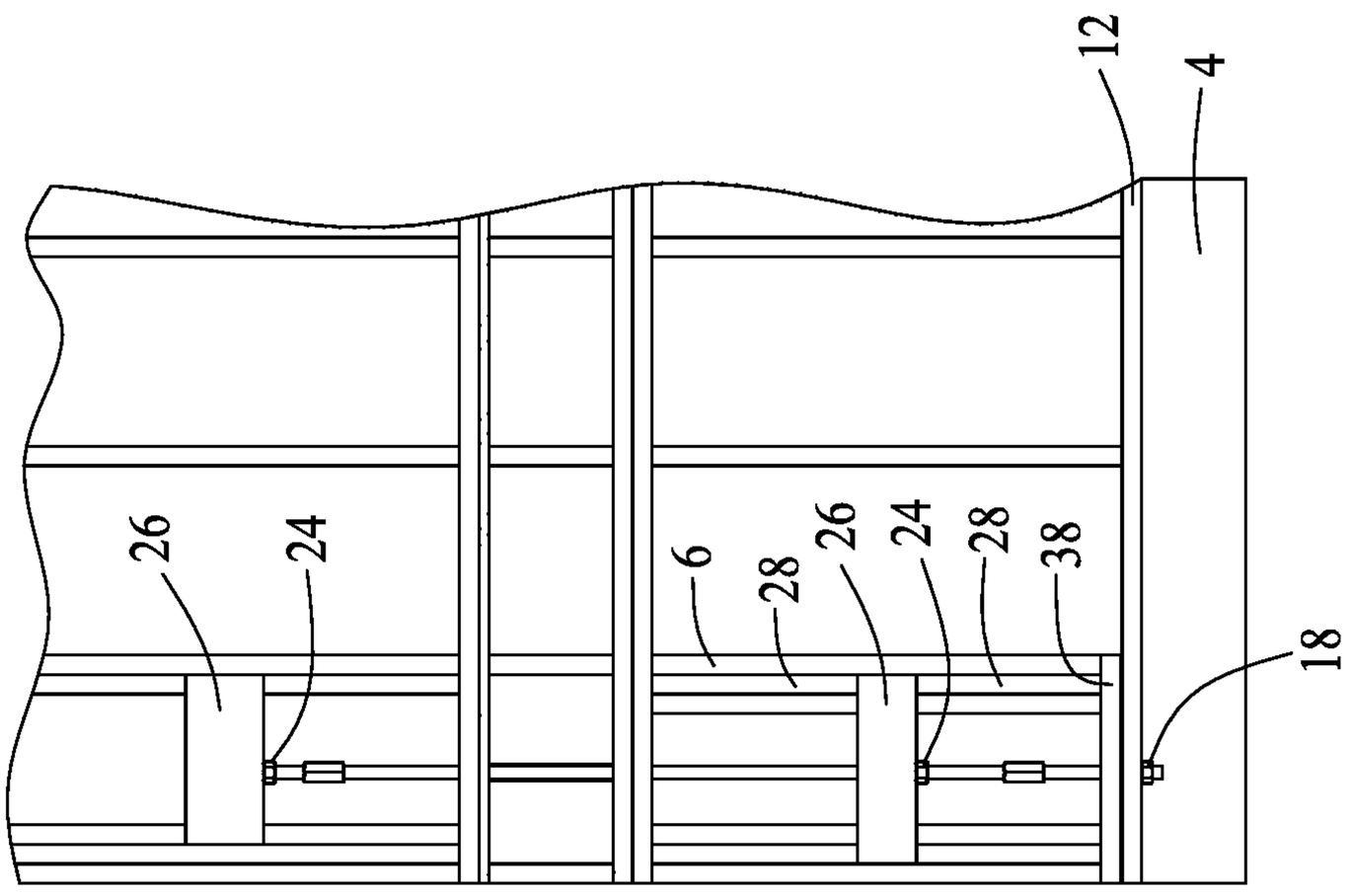

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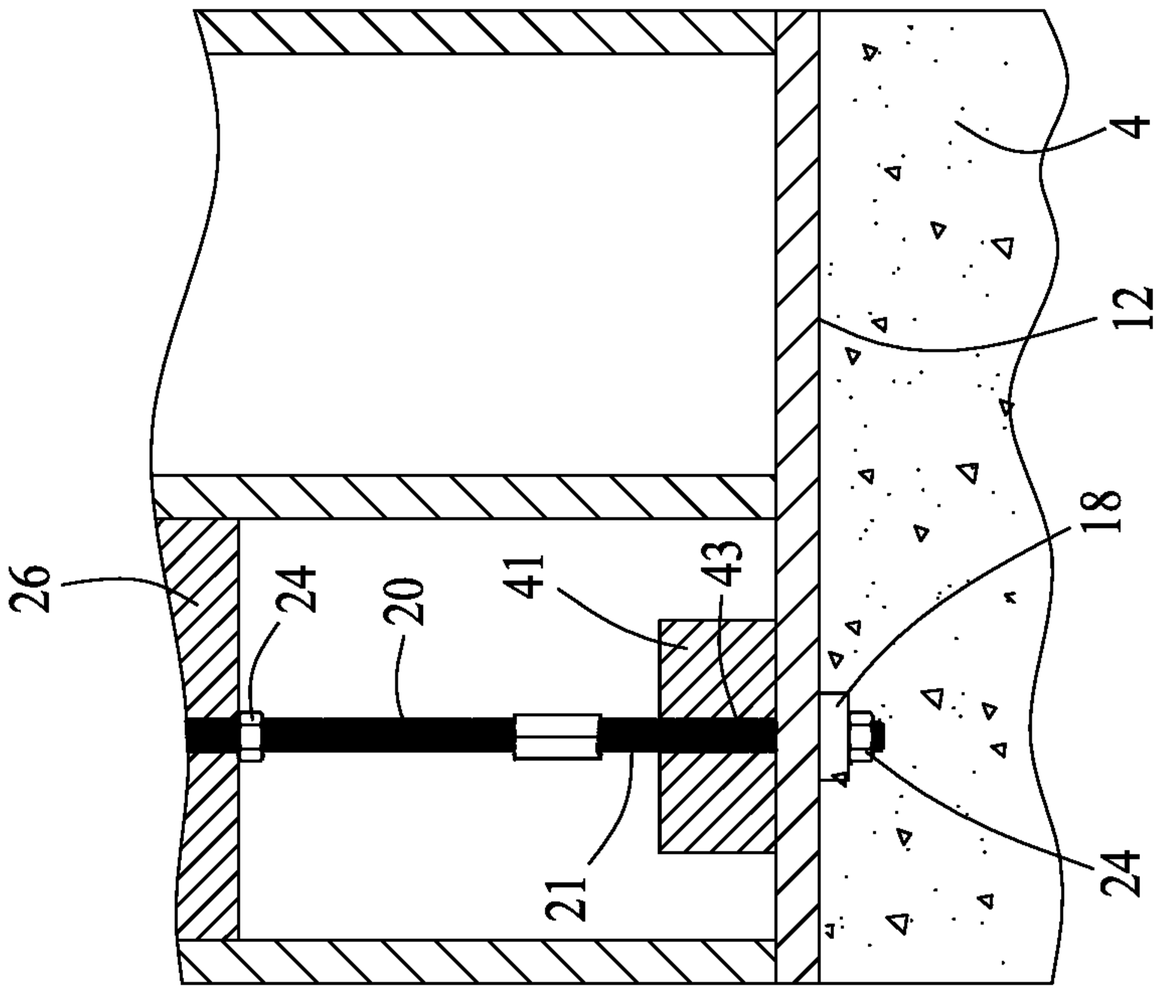

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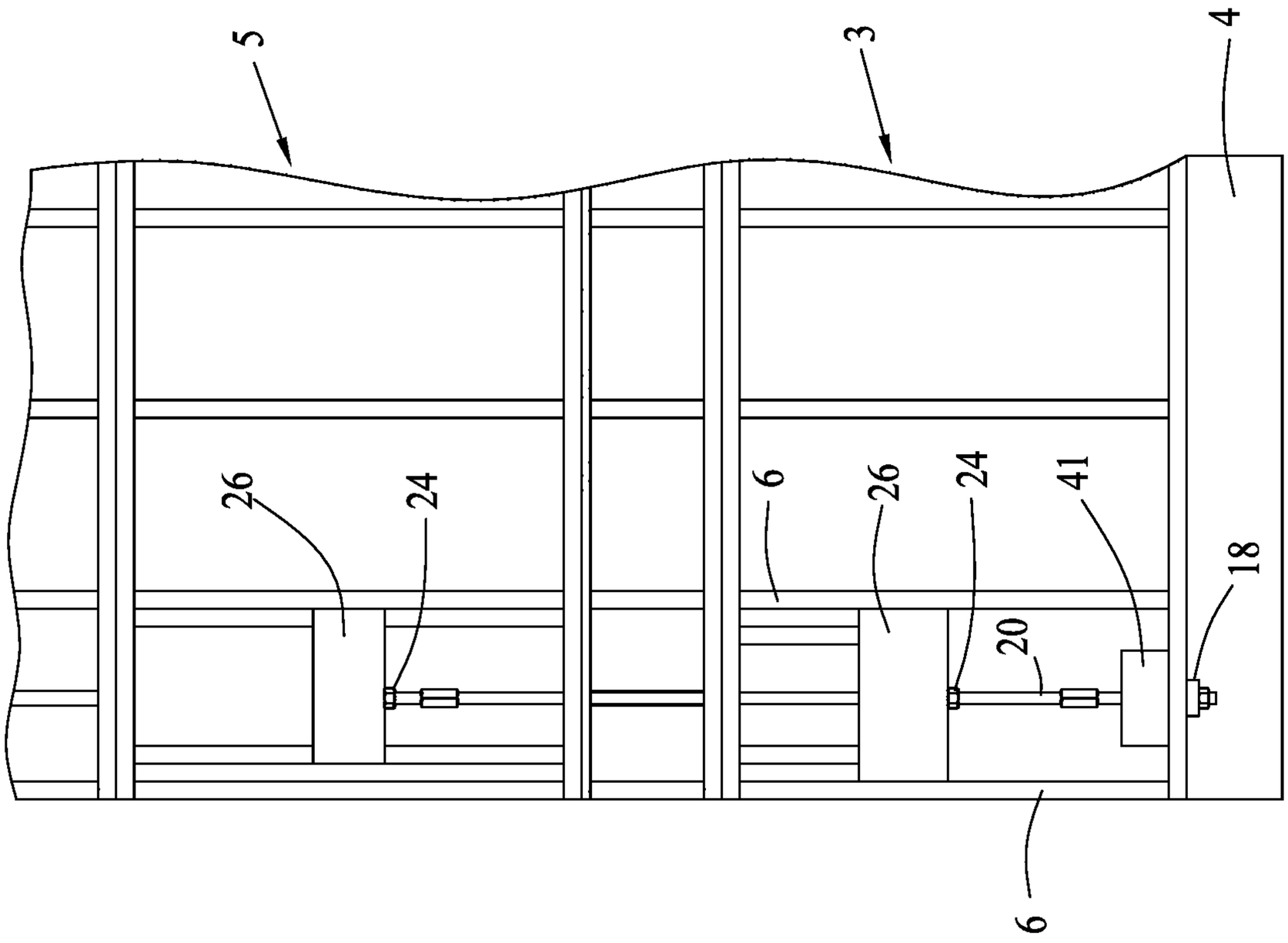

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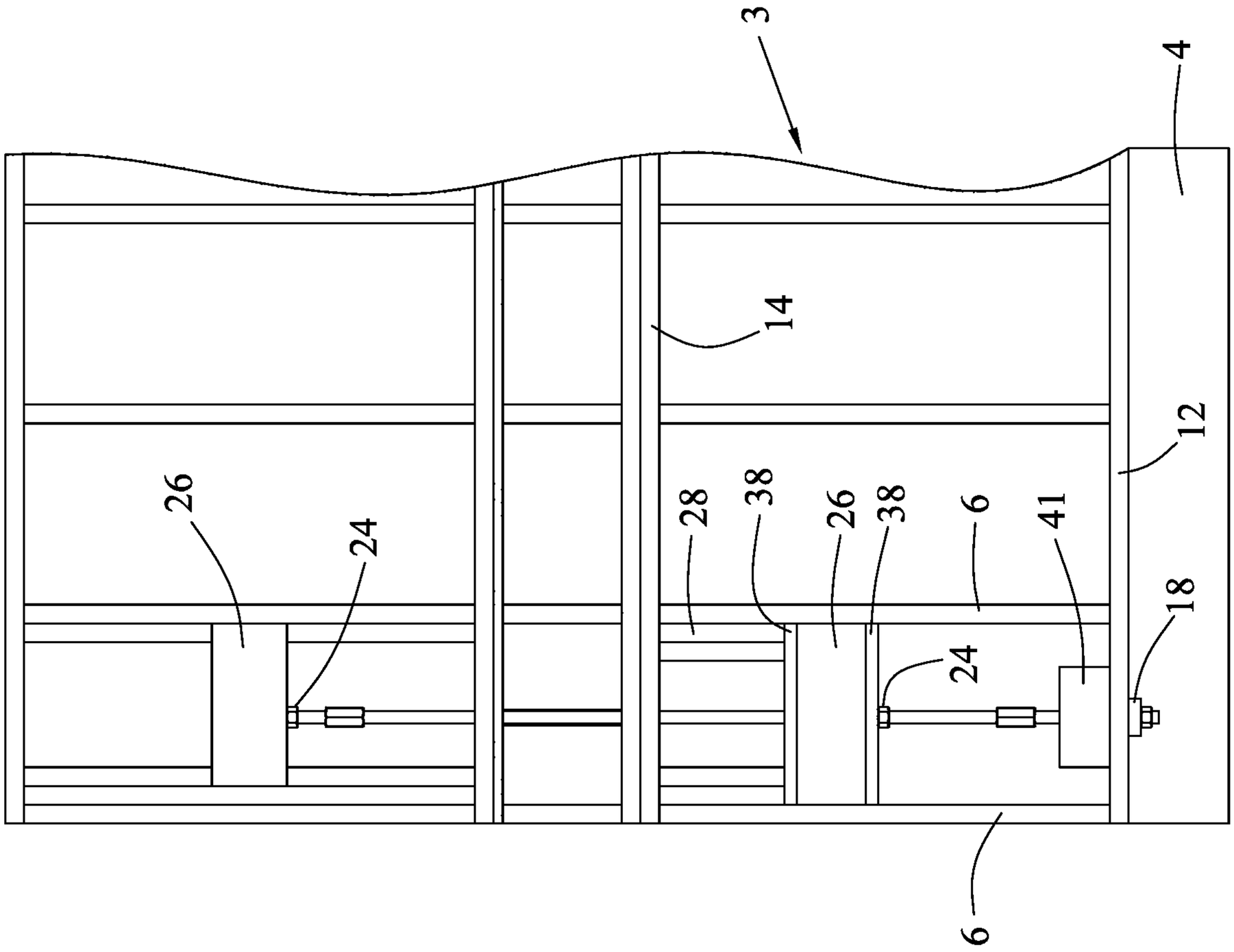
FIG. 8



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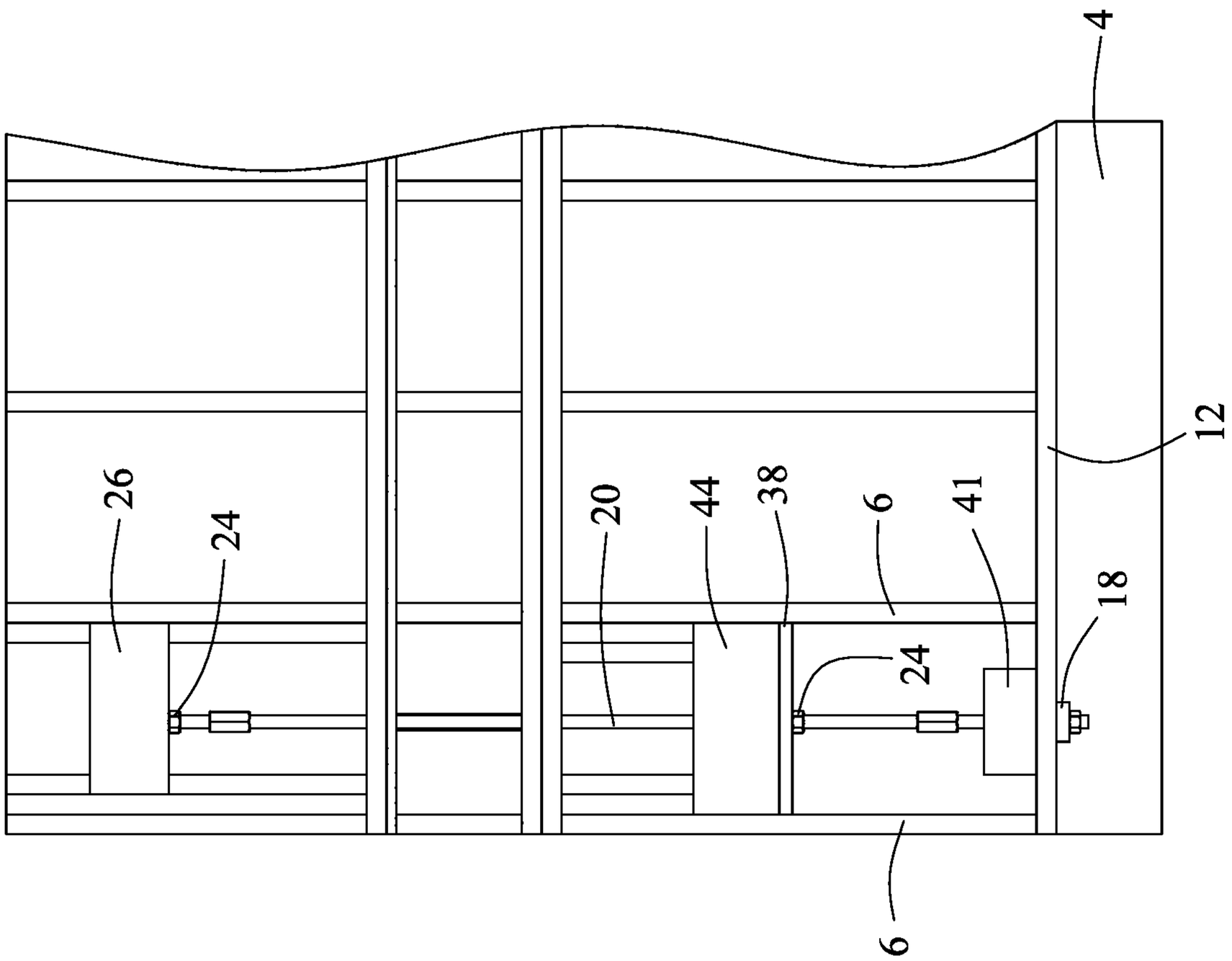

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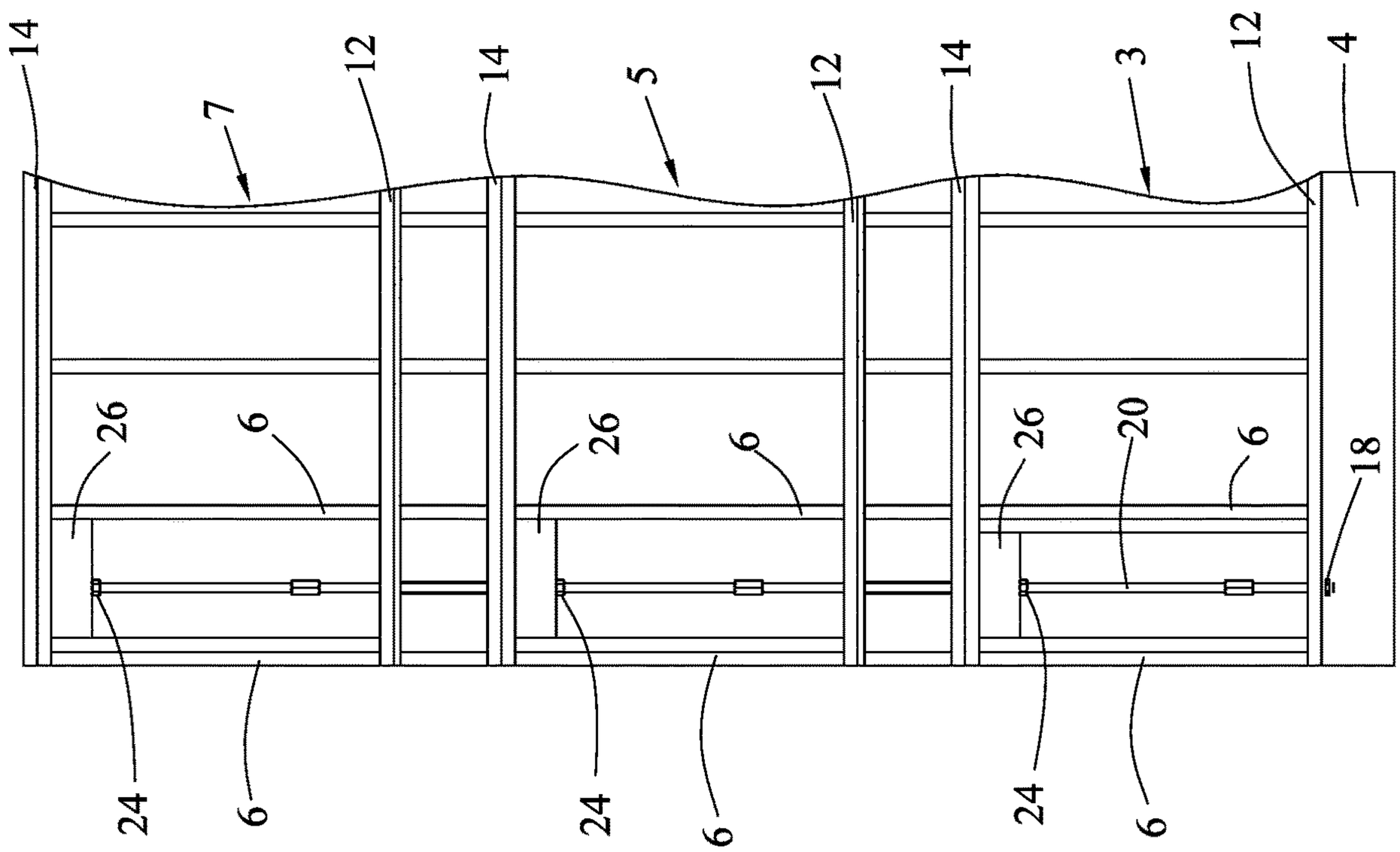

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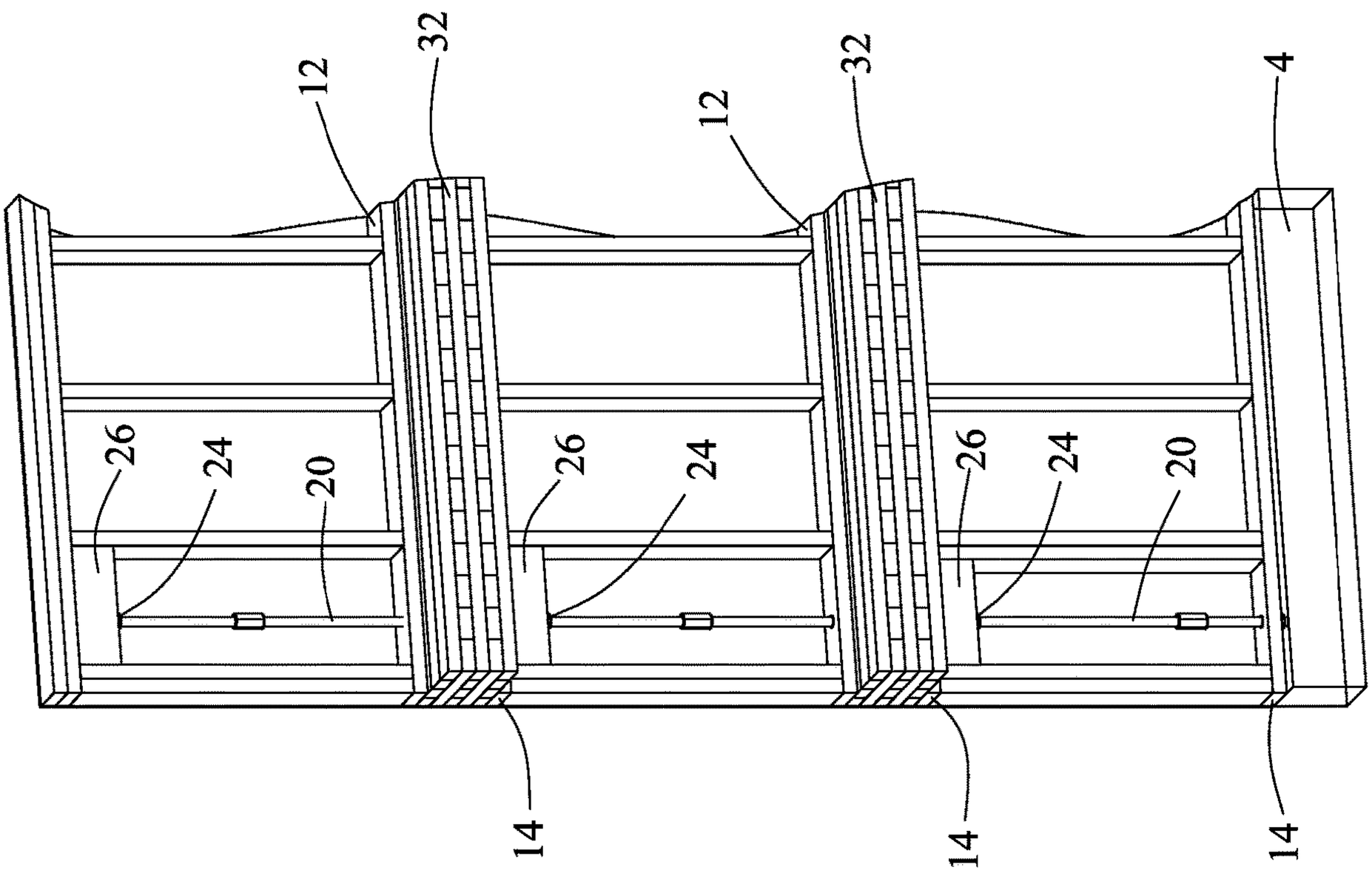
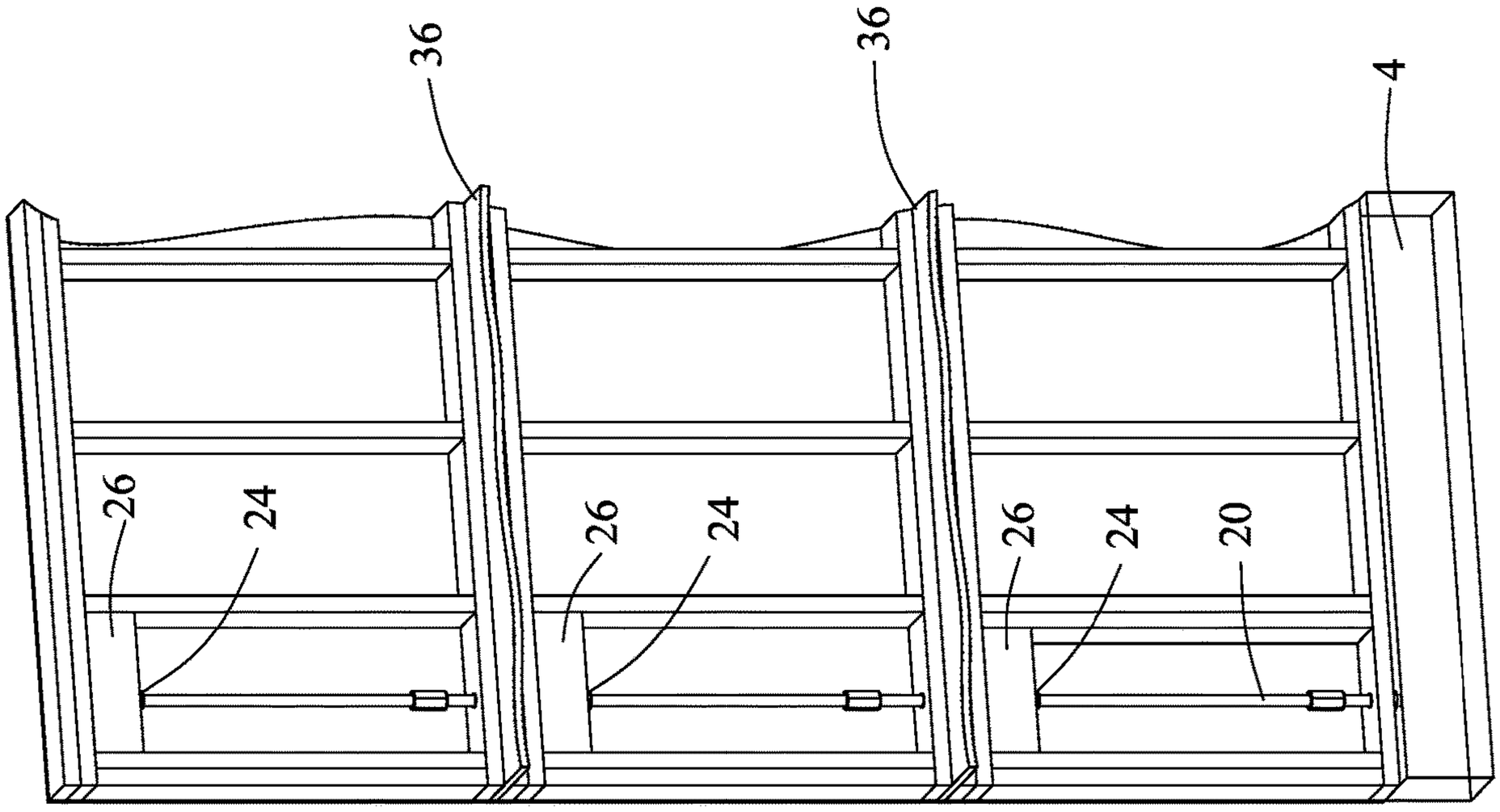
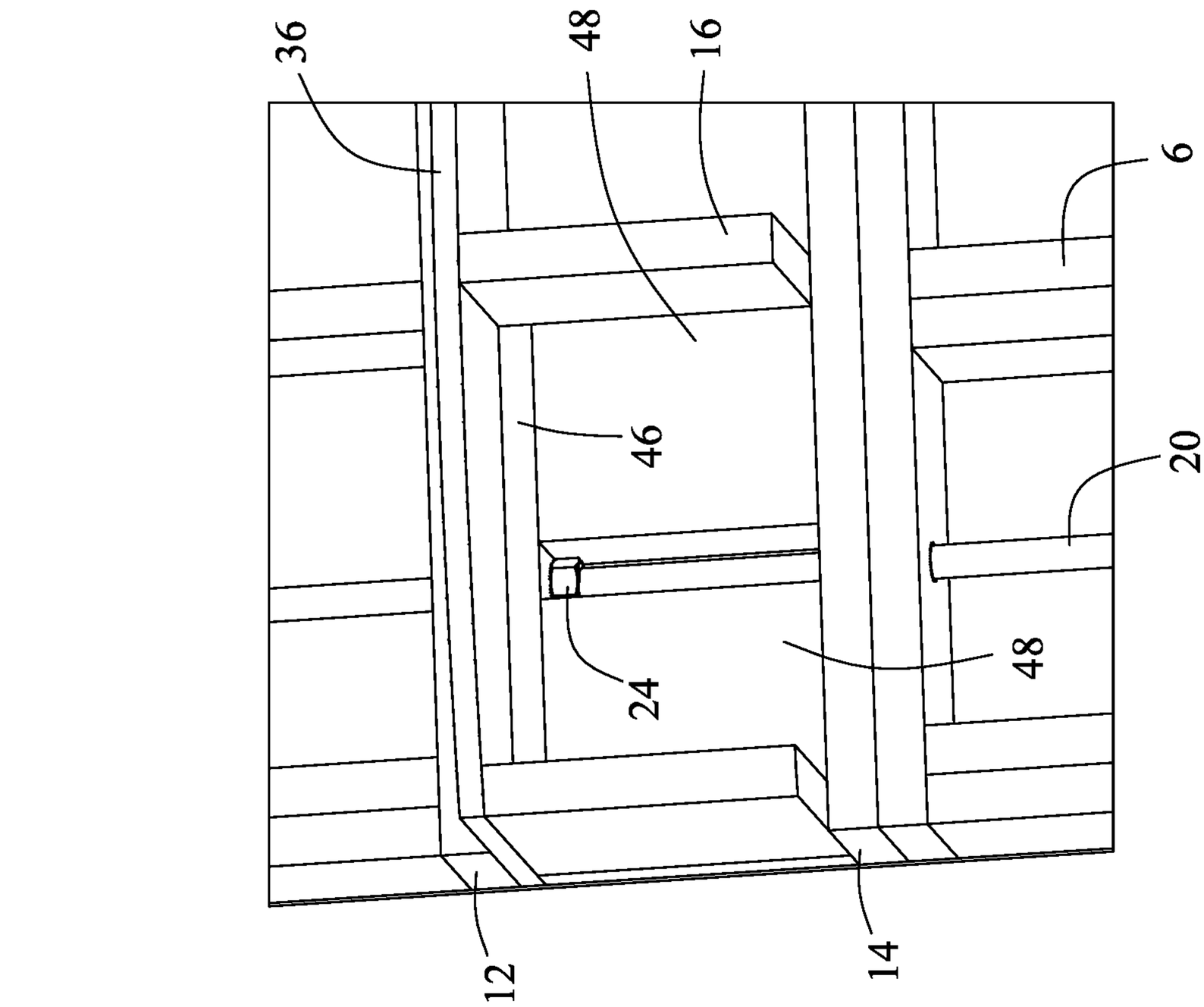


FIG. 1





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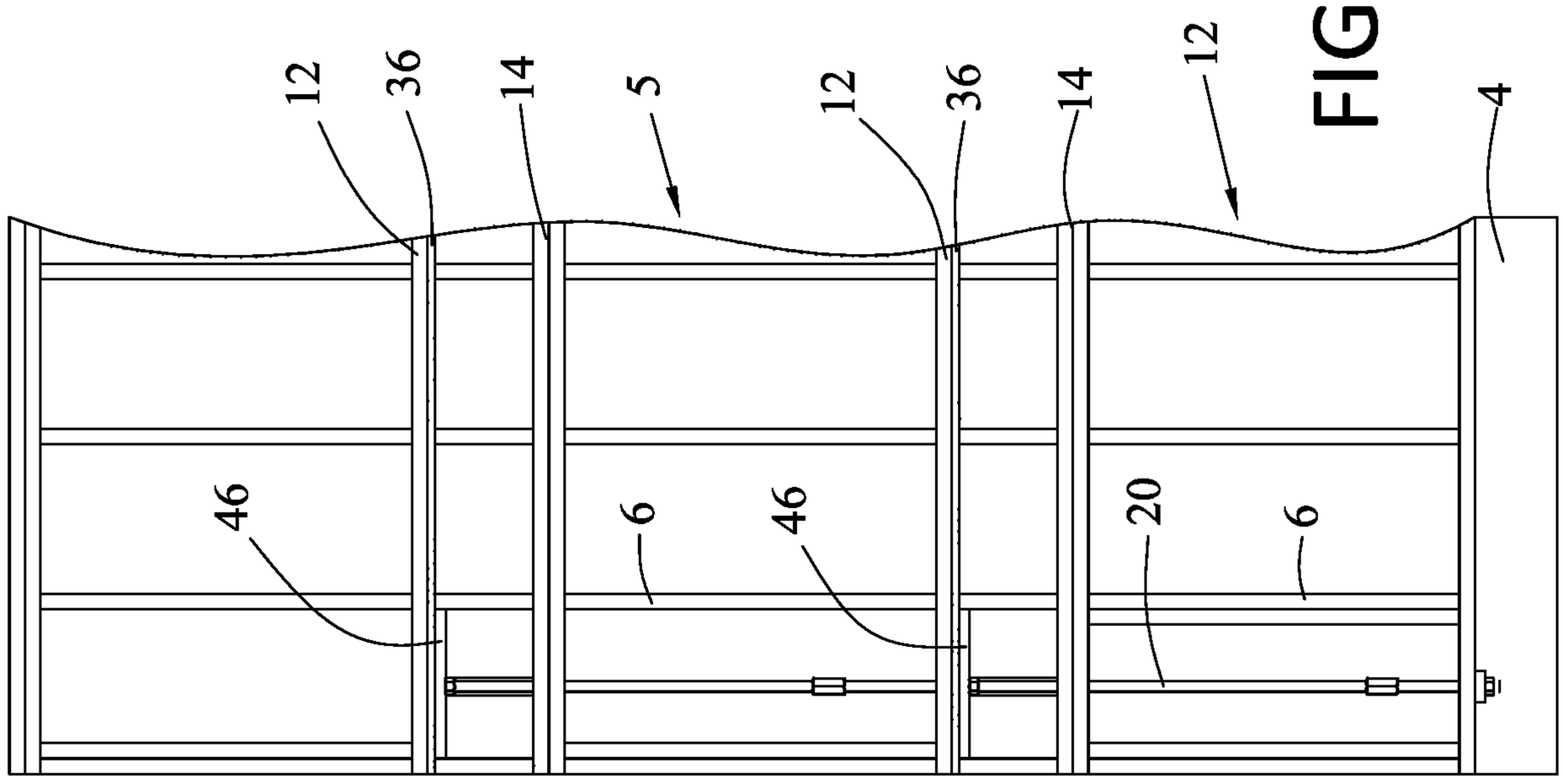

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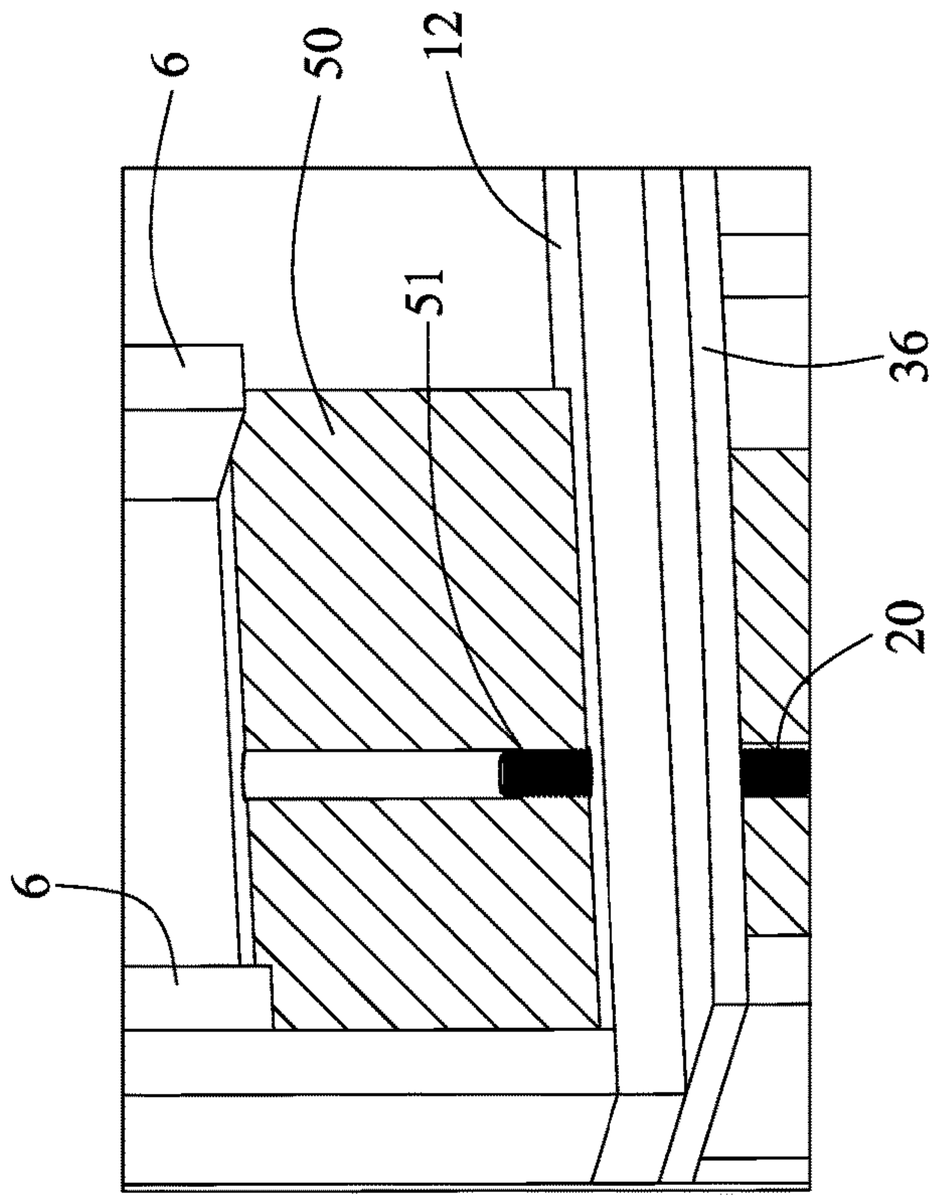

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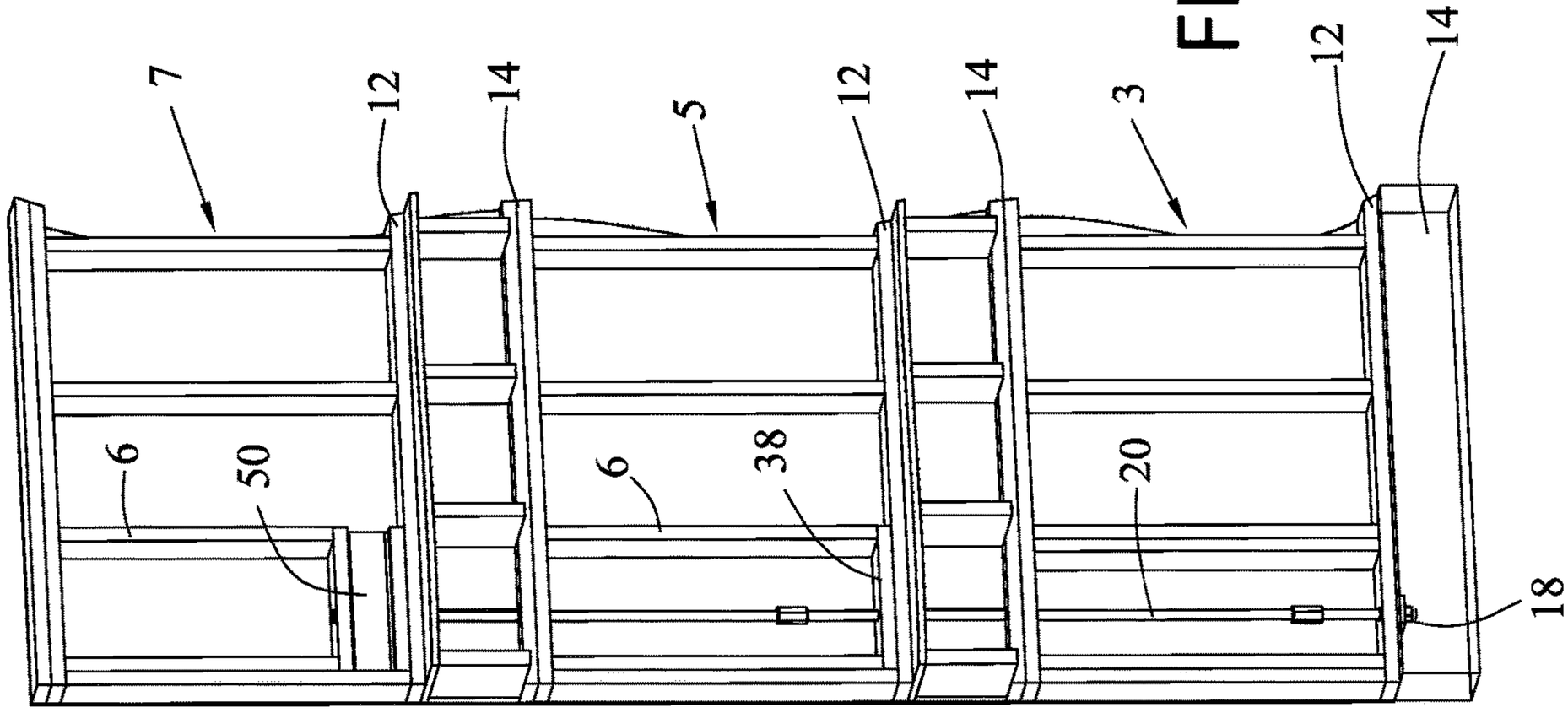

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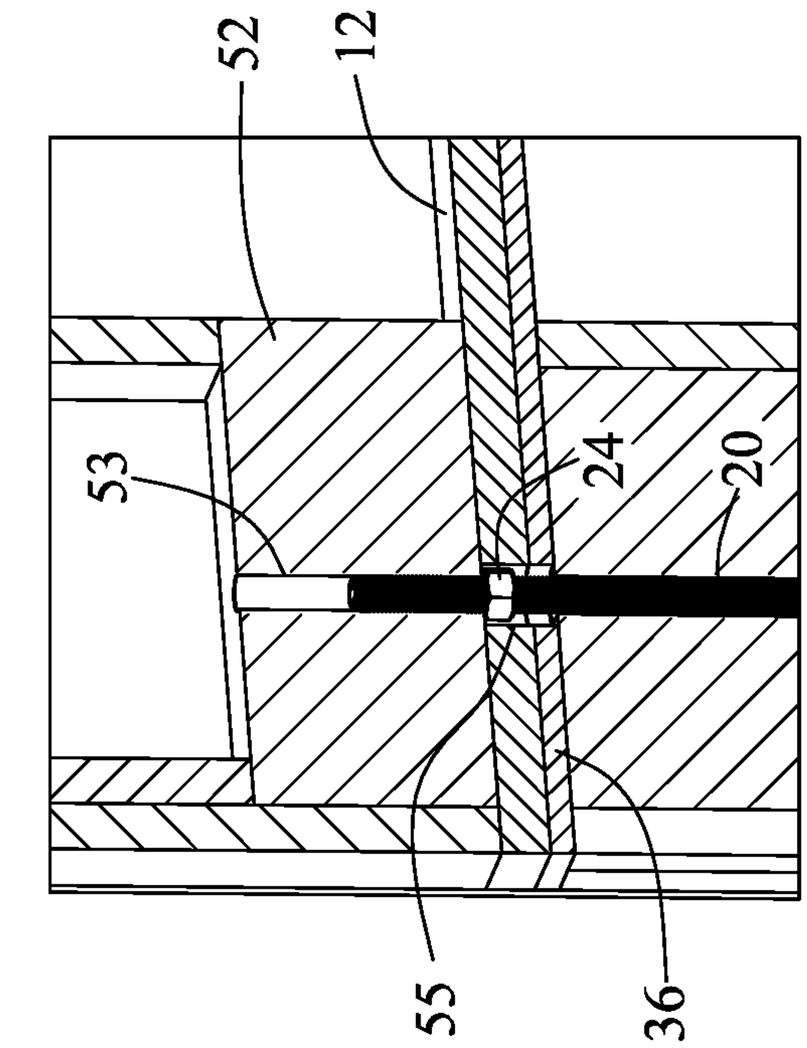
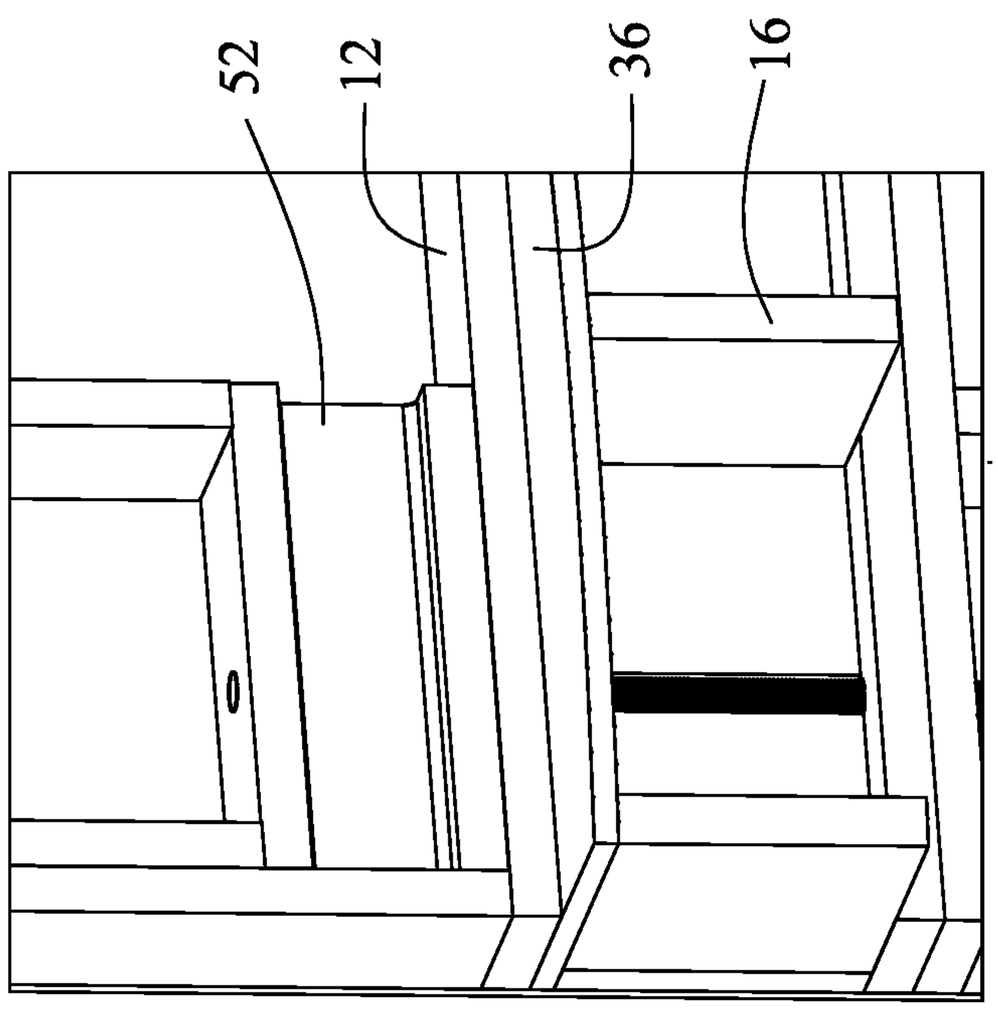


FIG. 18



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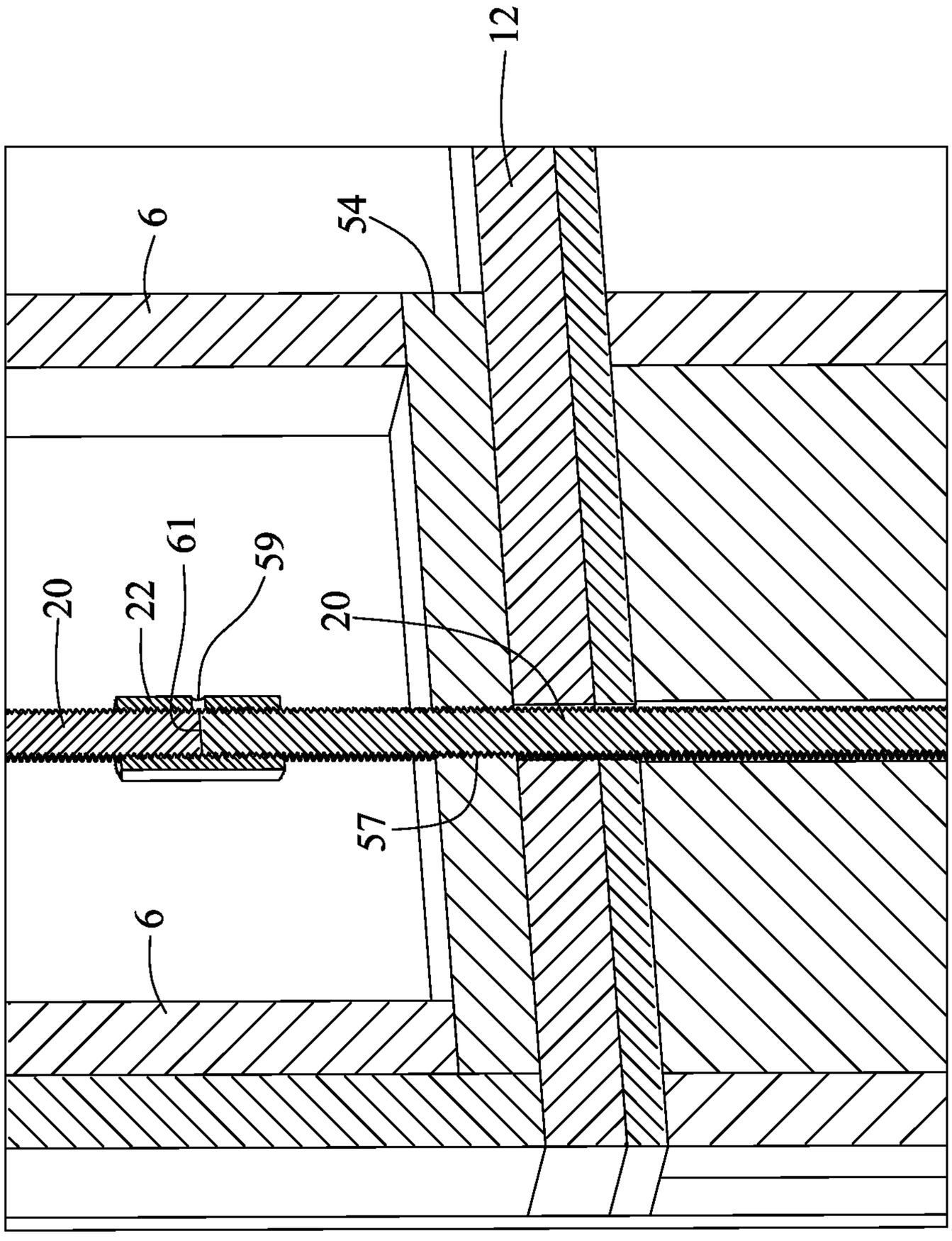

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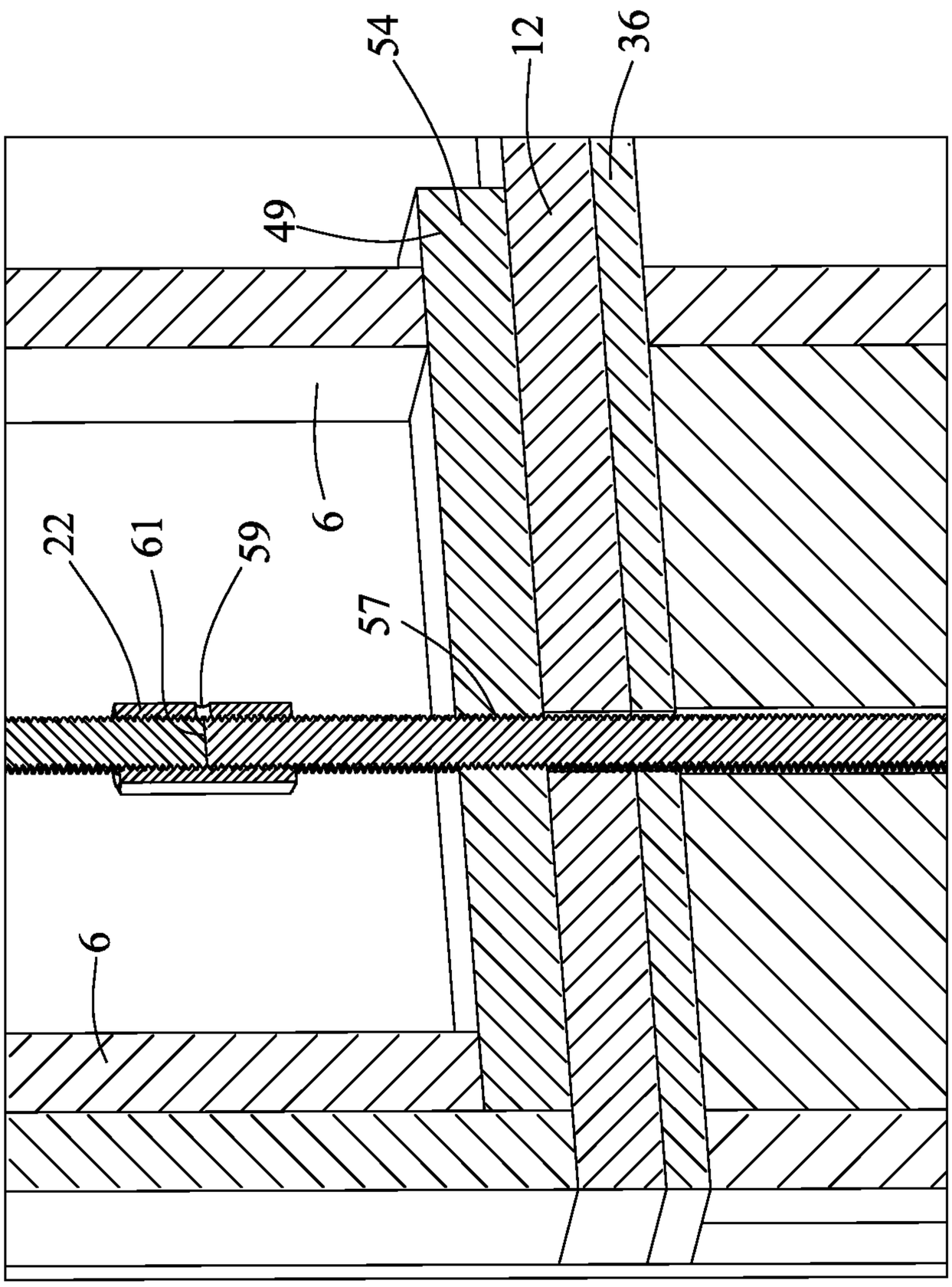

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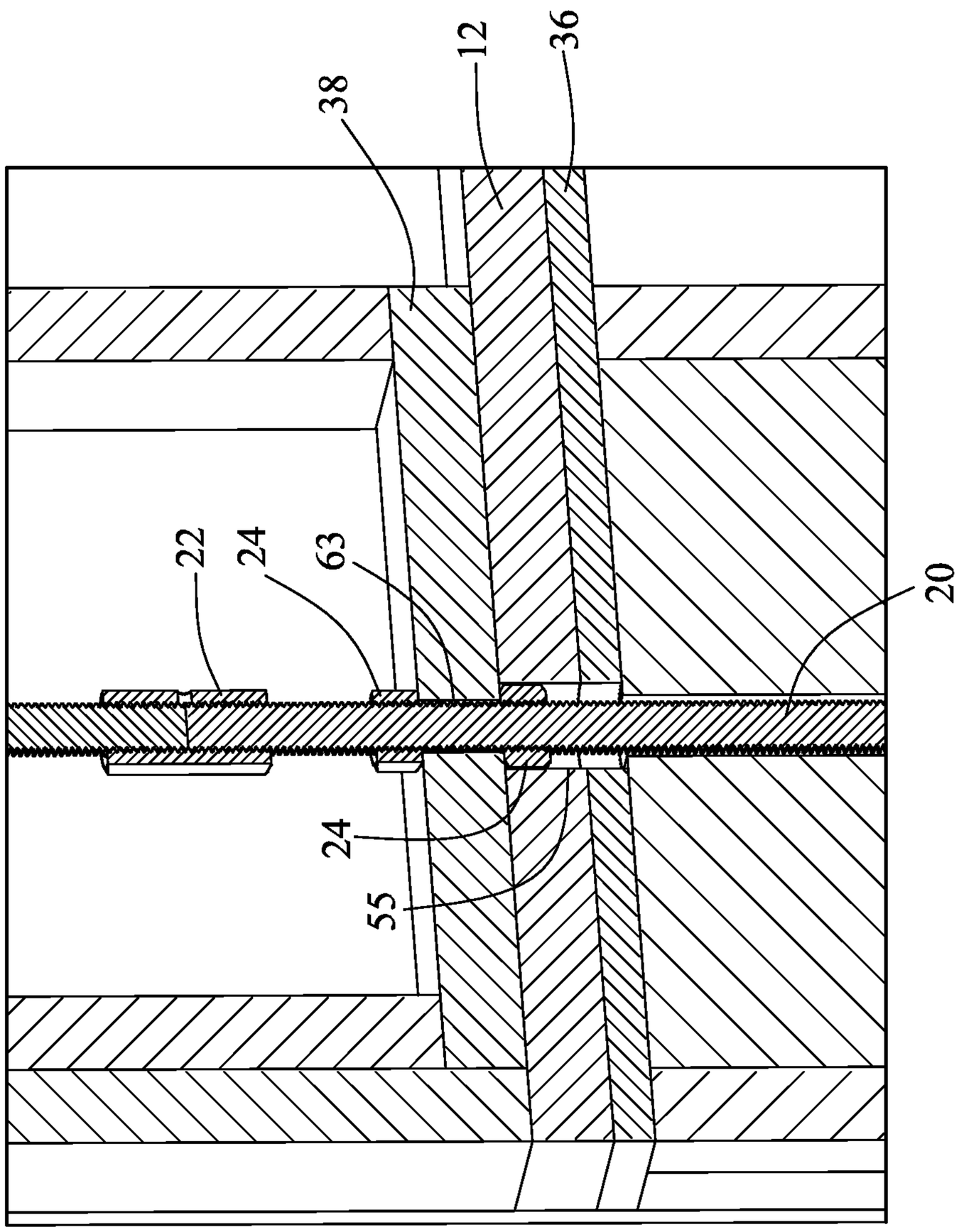

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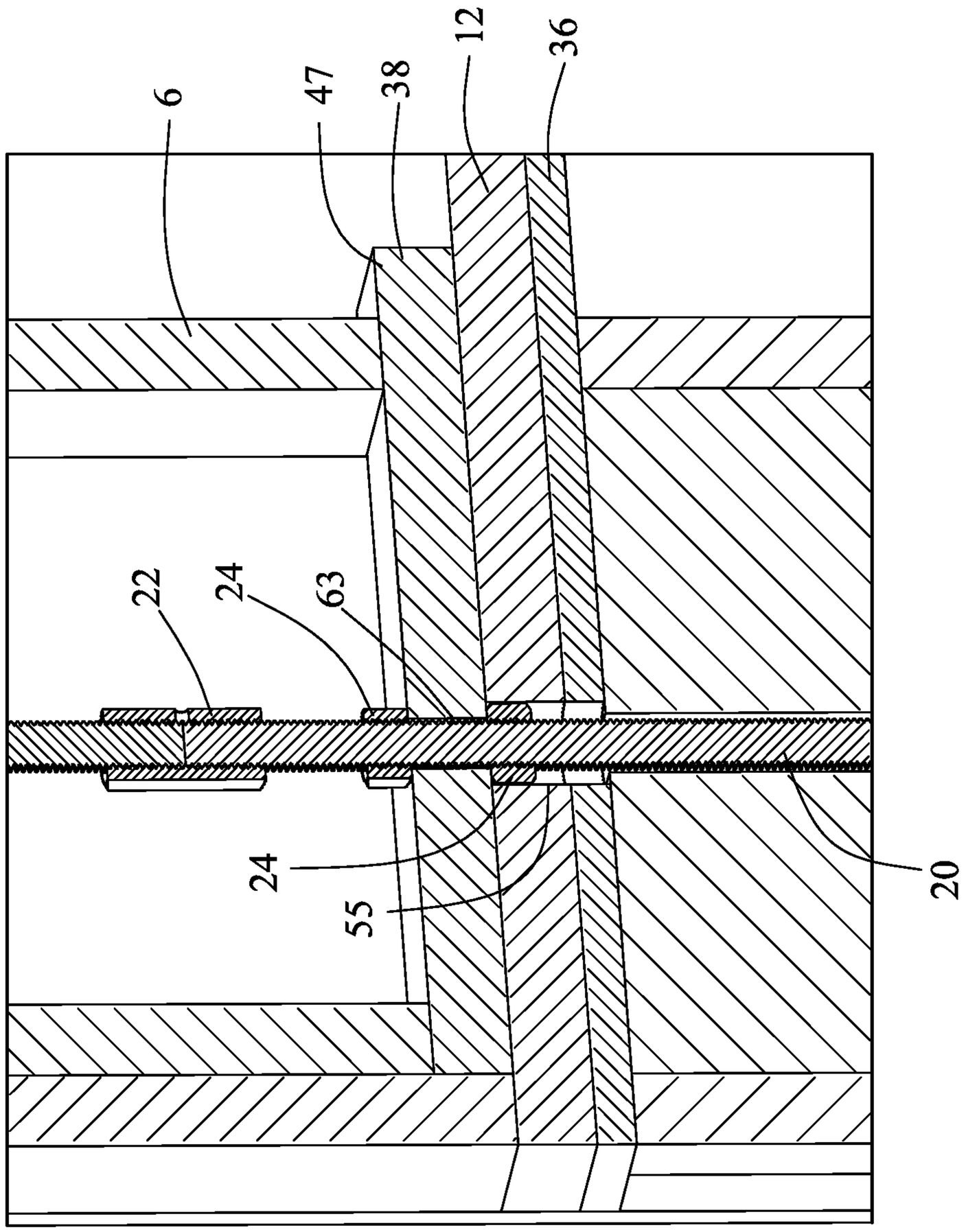

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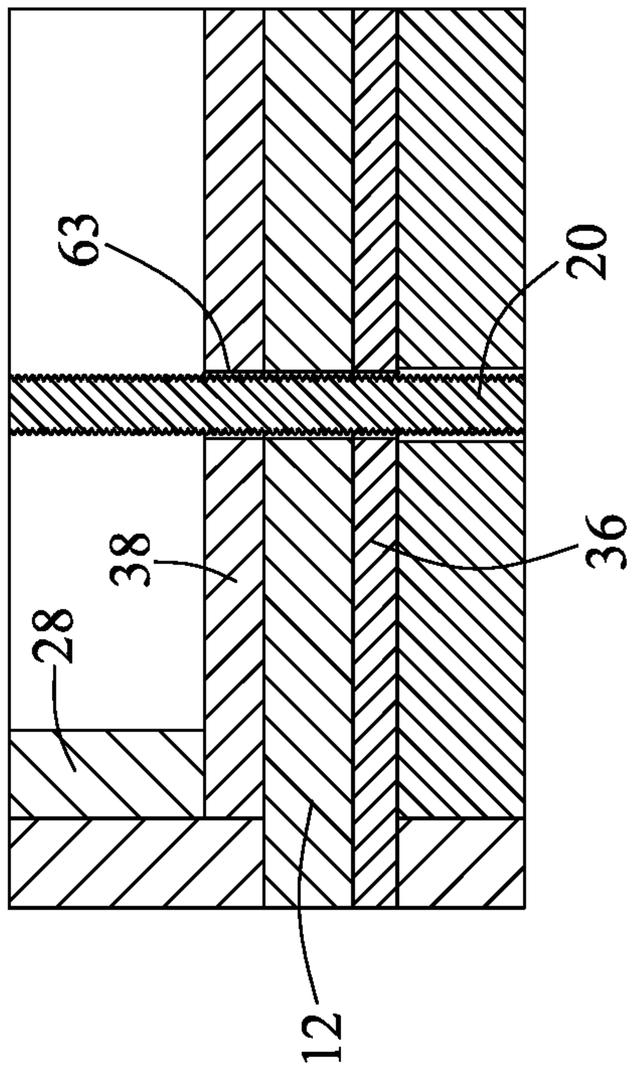


FIG. 24A

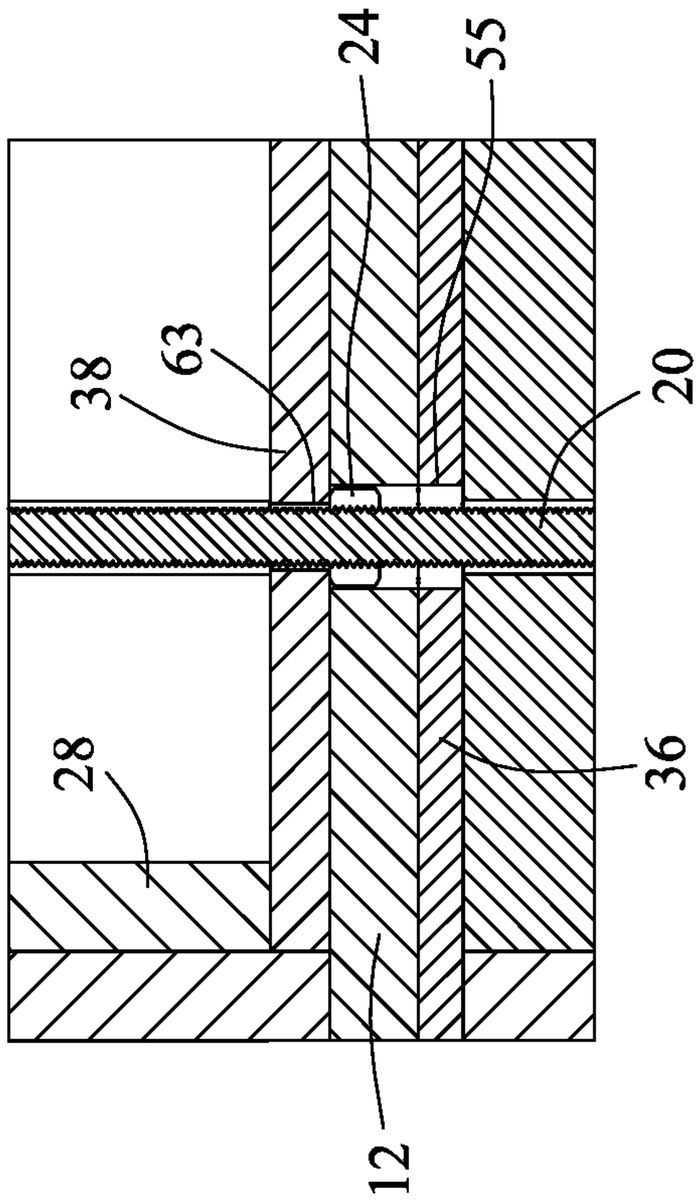
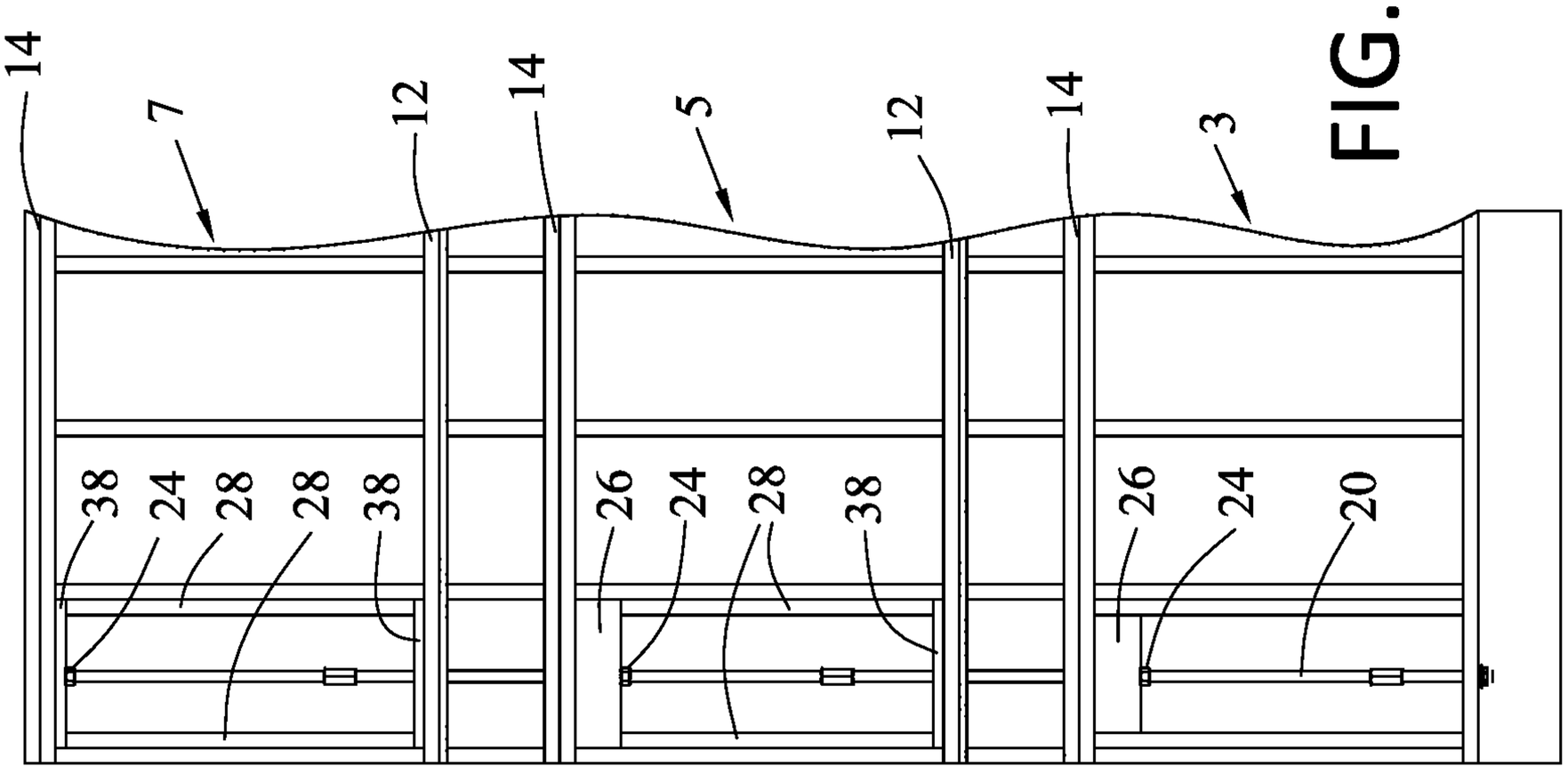


FIG. 24B



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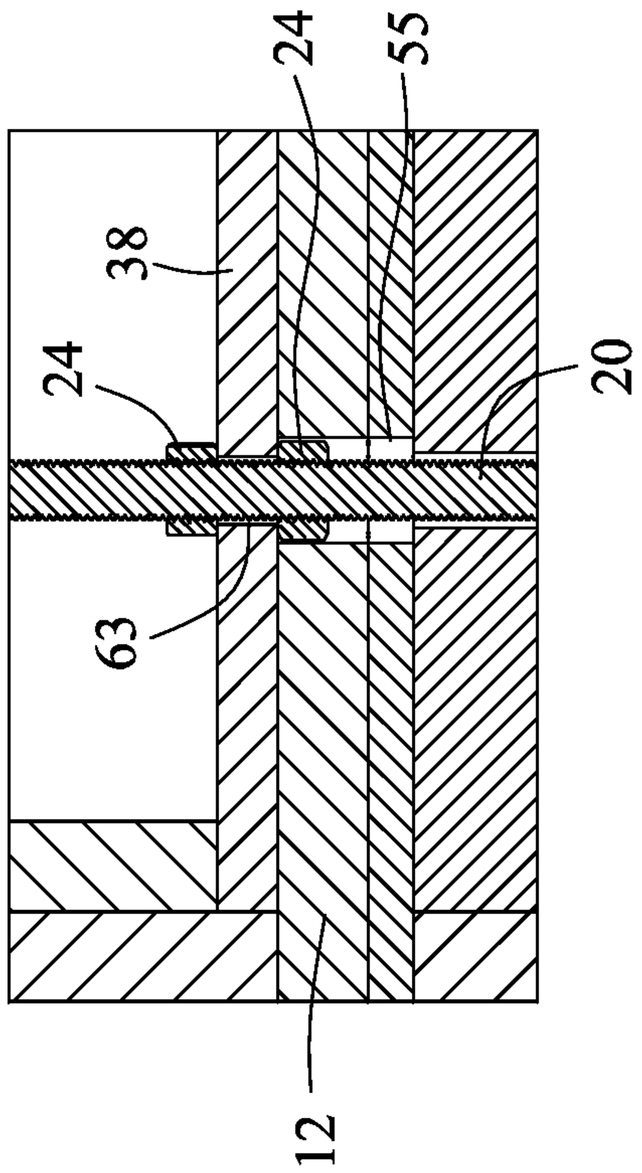

FIG. 26A

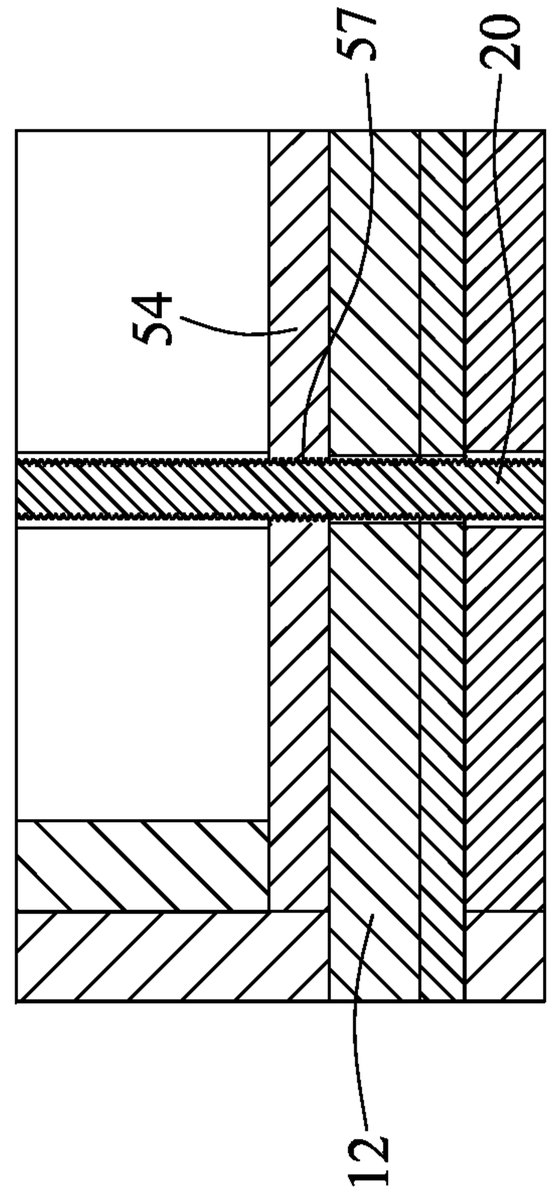

FIG. 26B

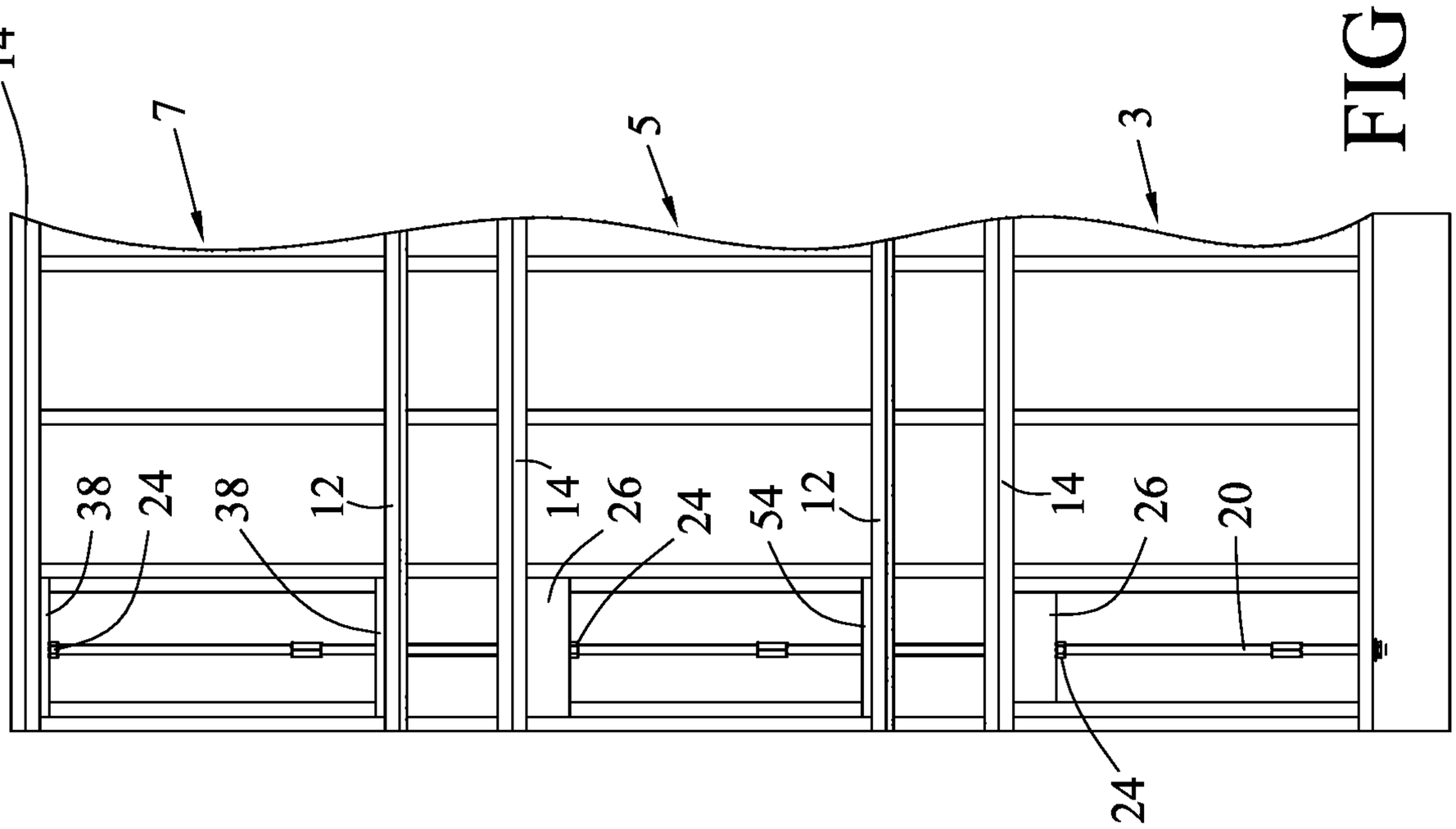

FIG. 25

FIG. 2

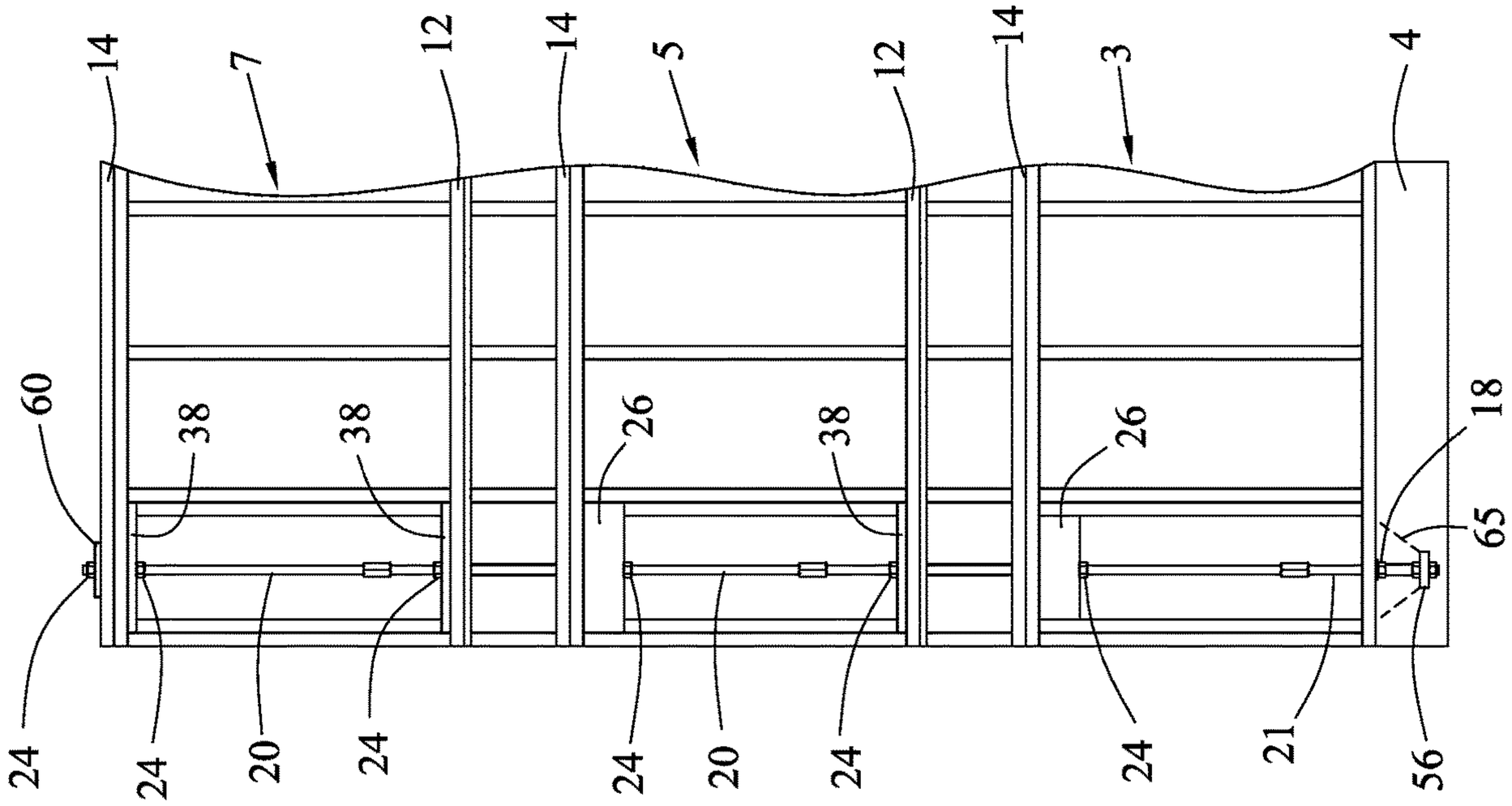
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FIG. 2

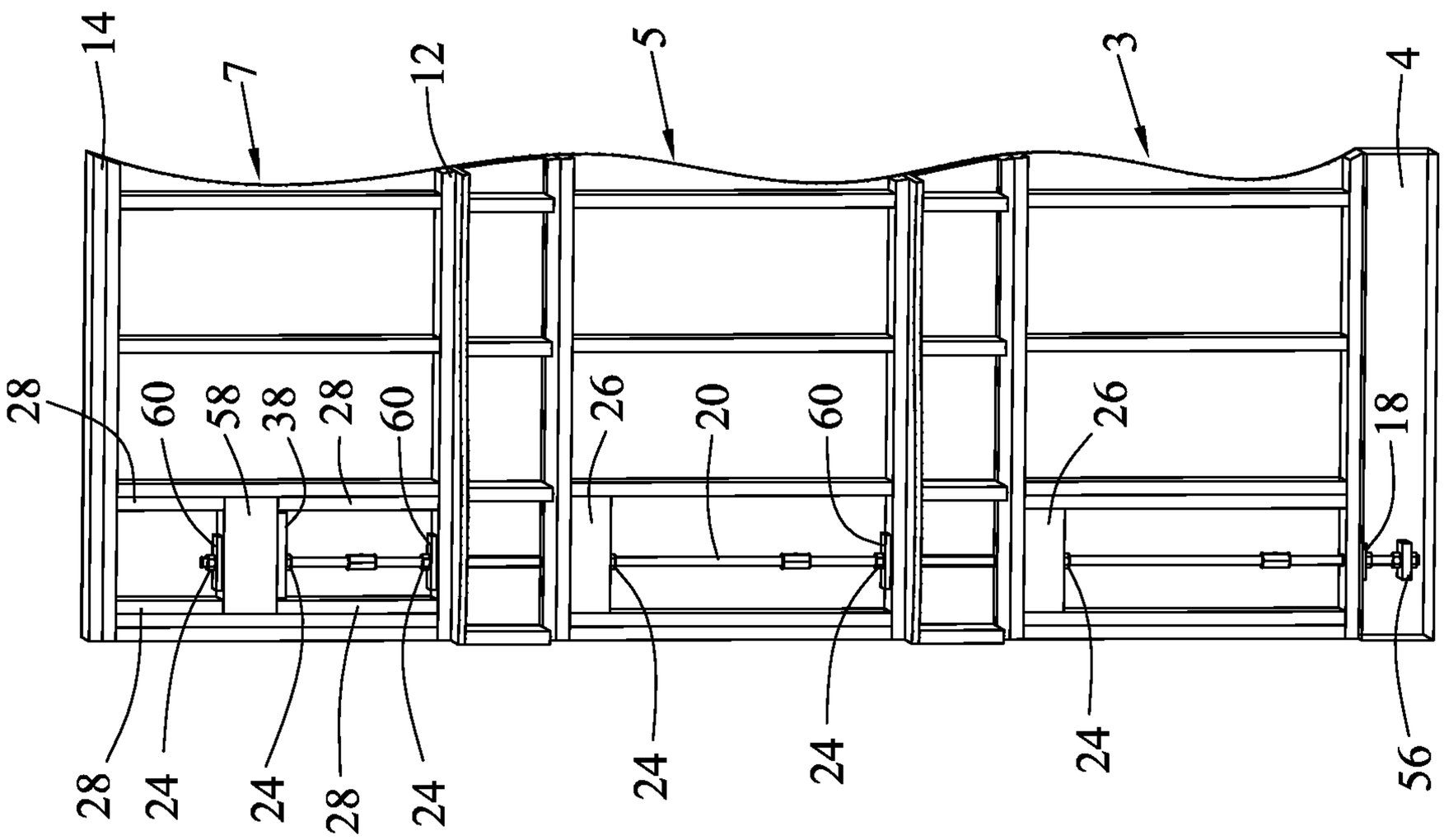
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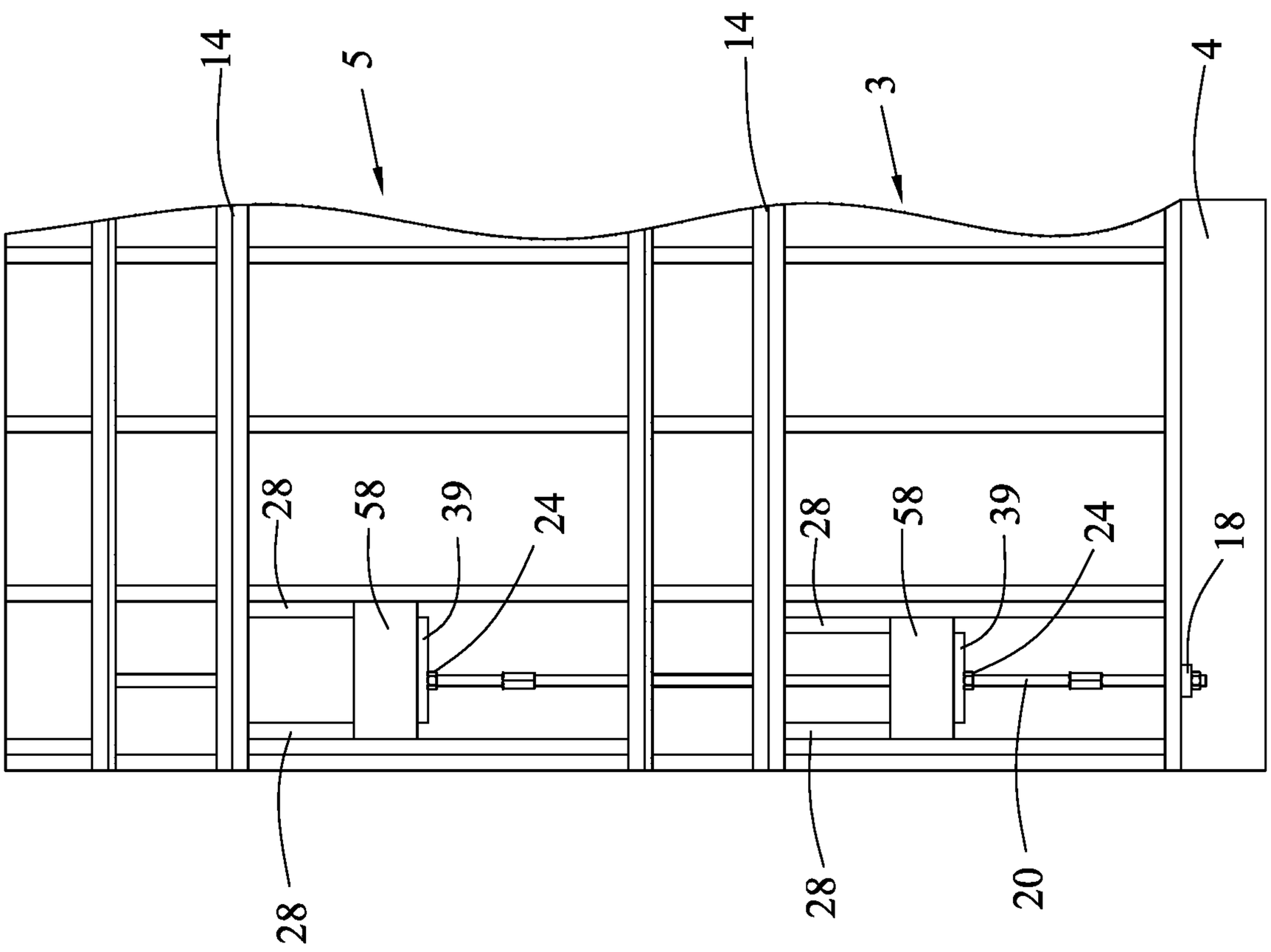
FIG. 29



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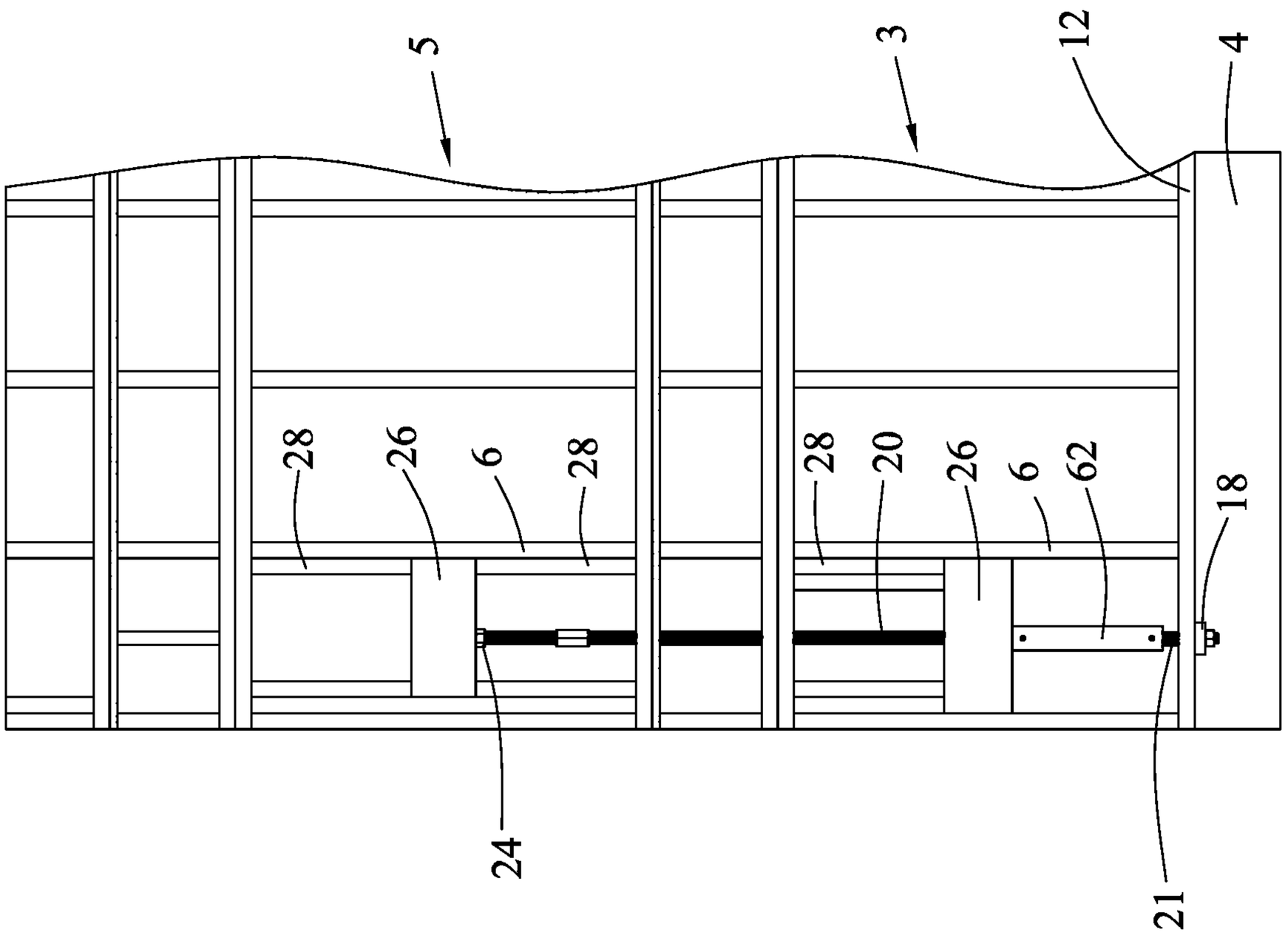

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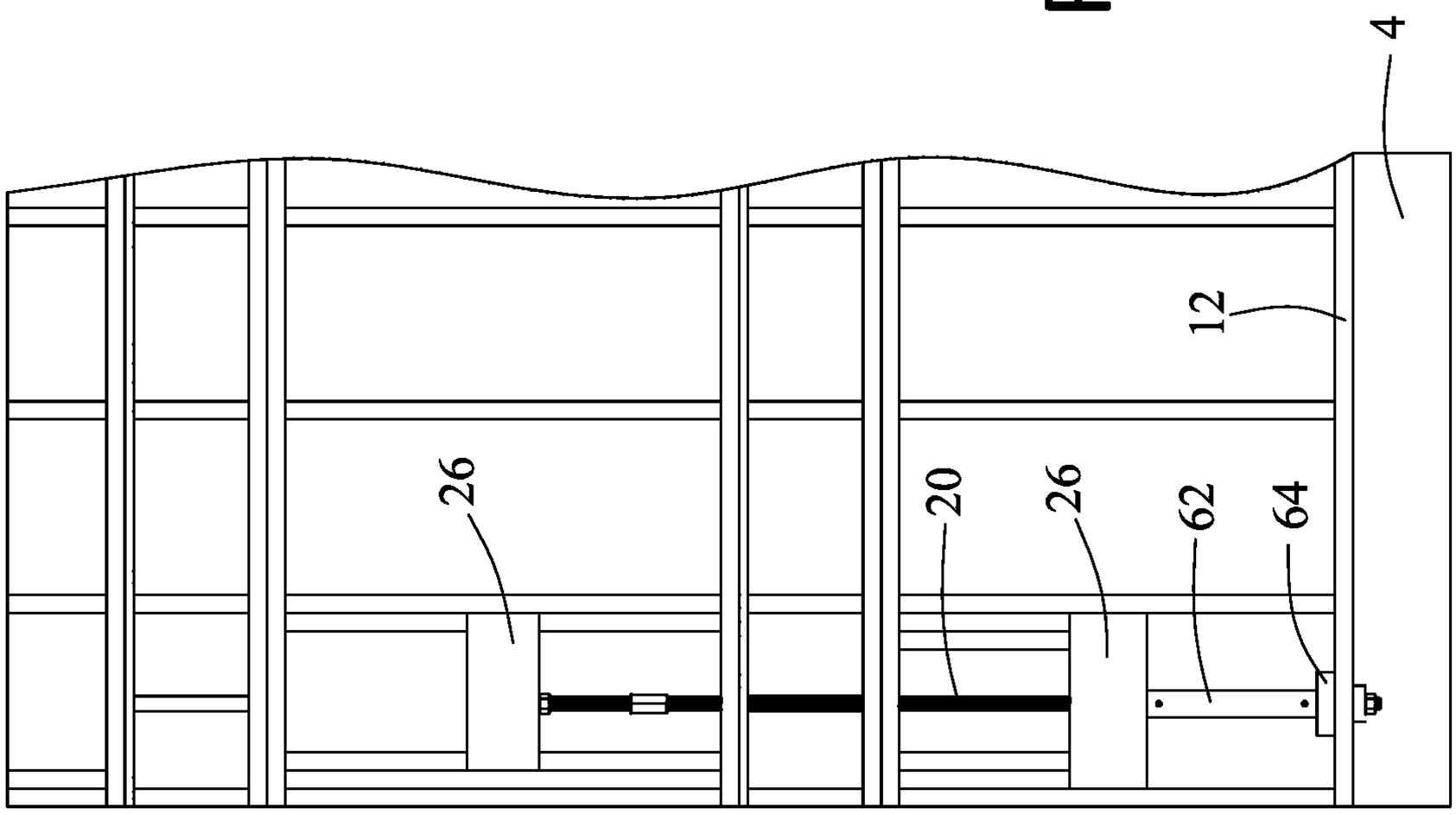

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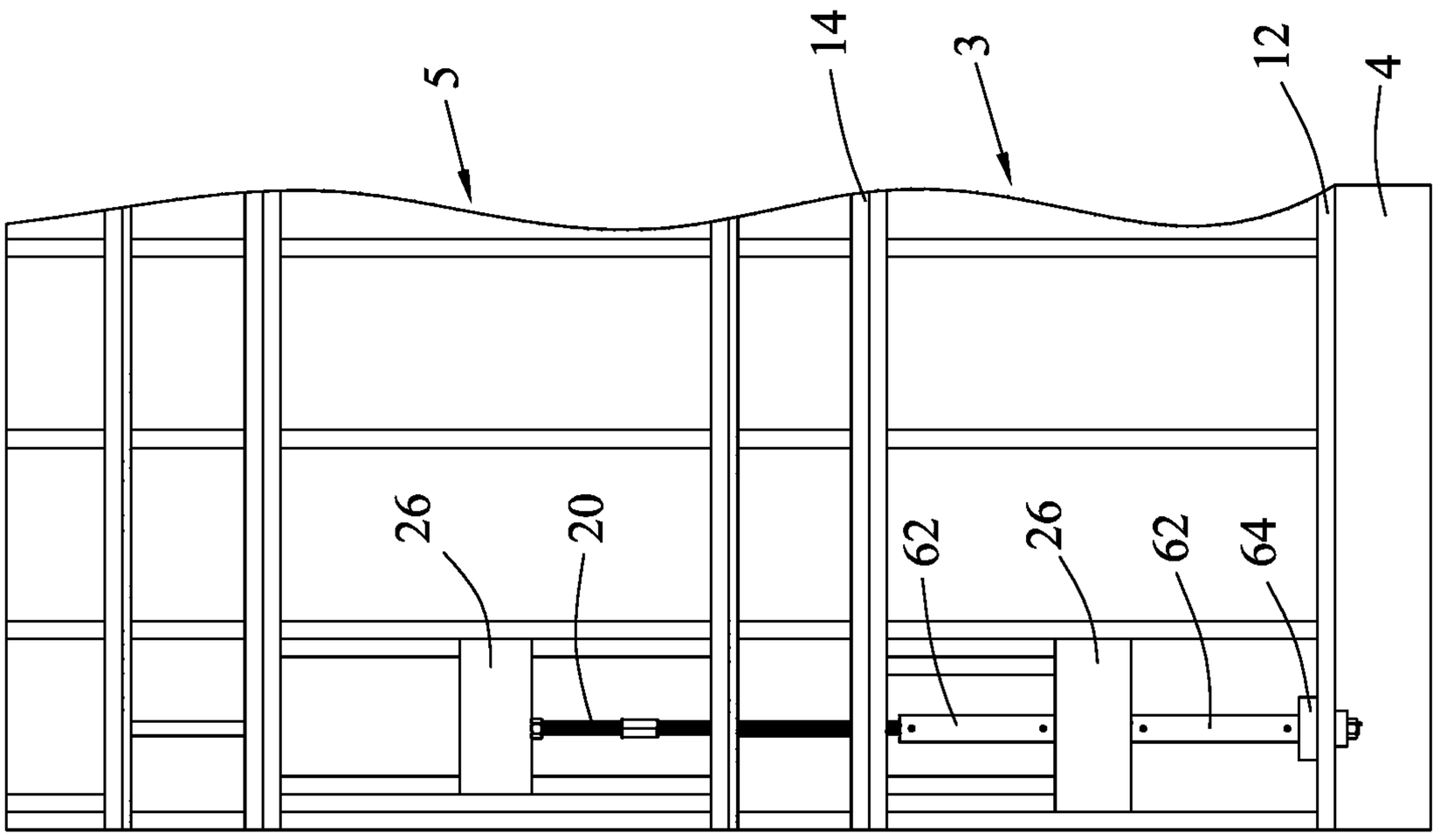

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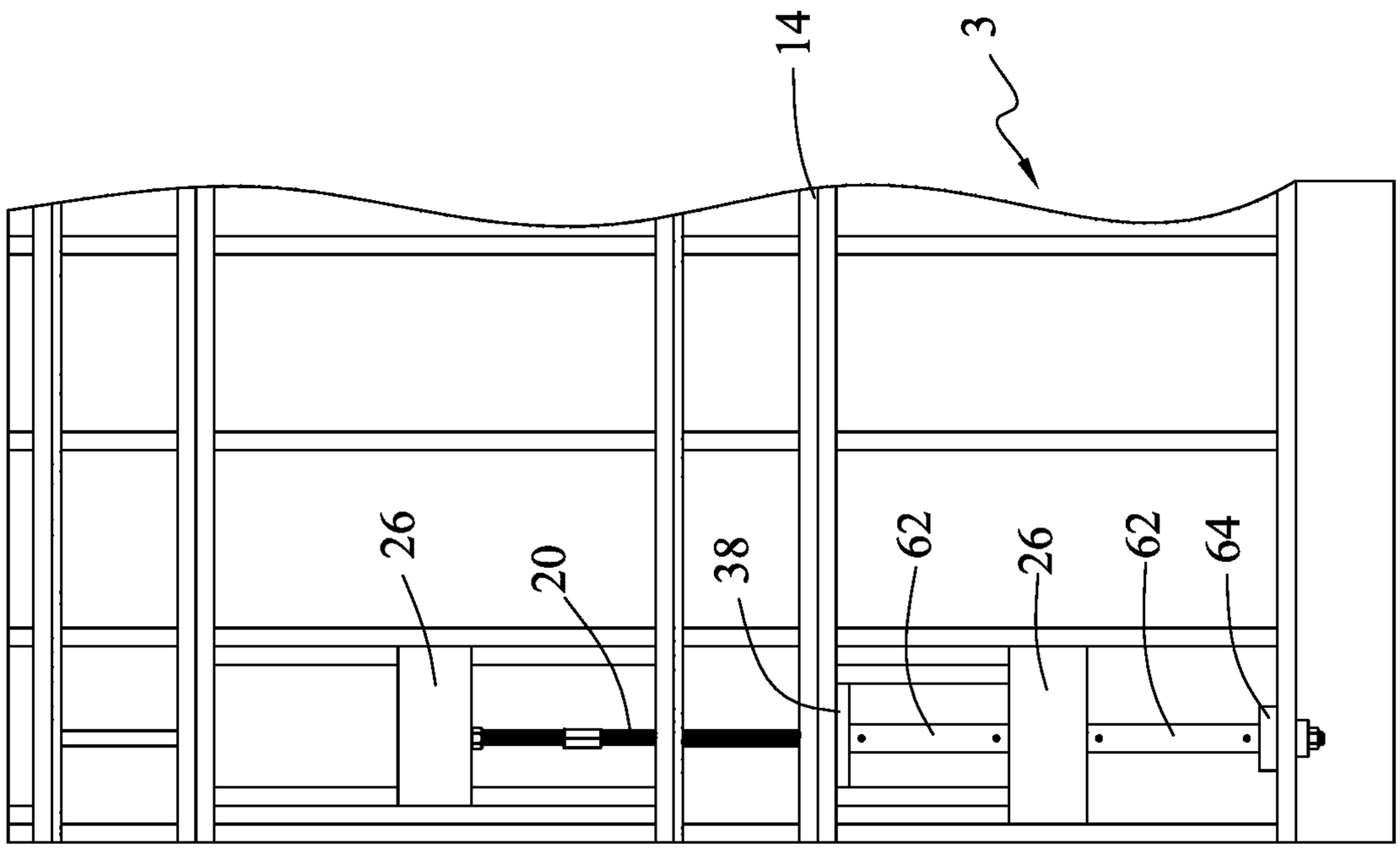

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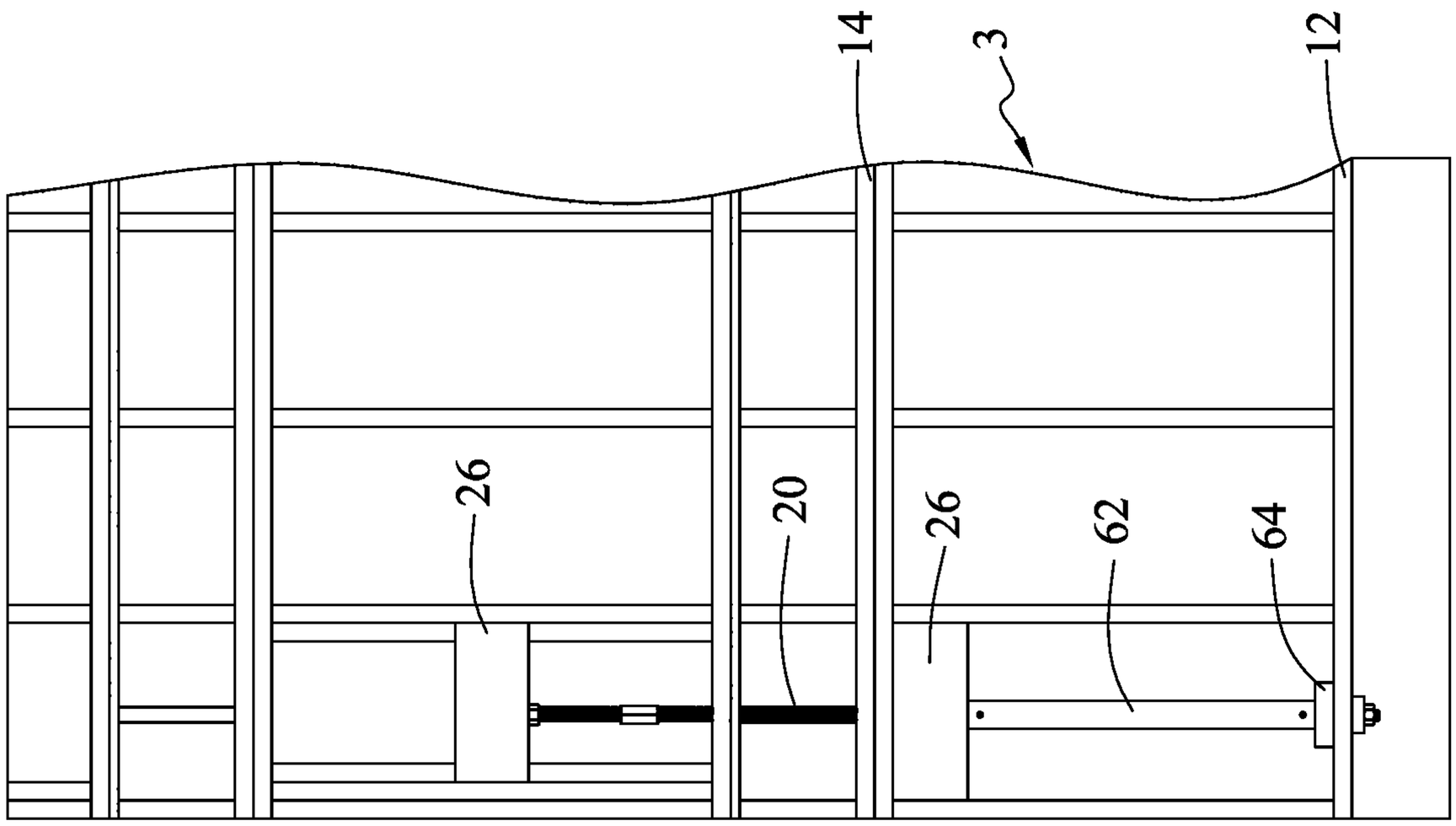


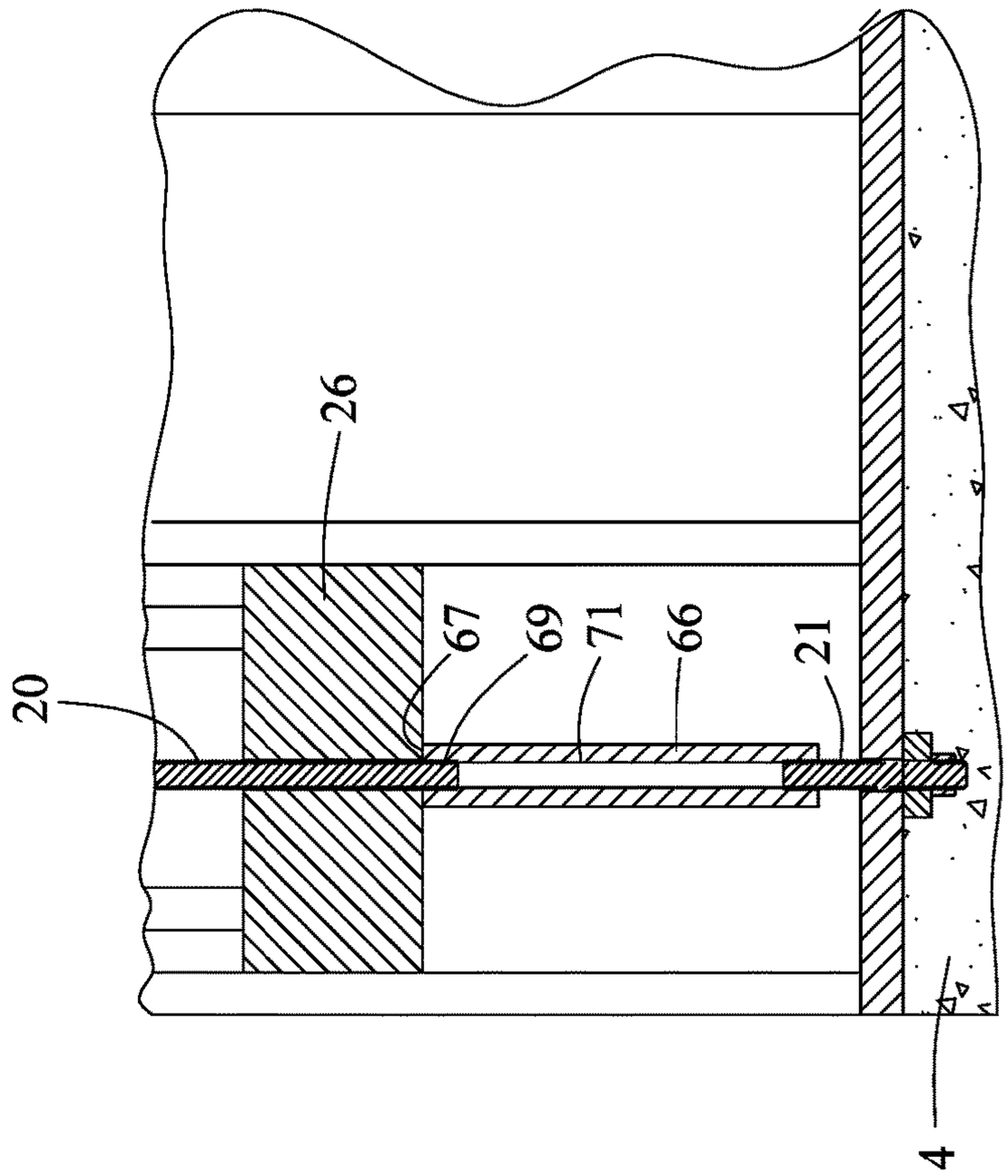


FIG. 36

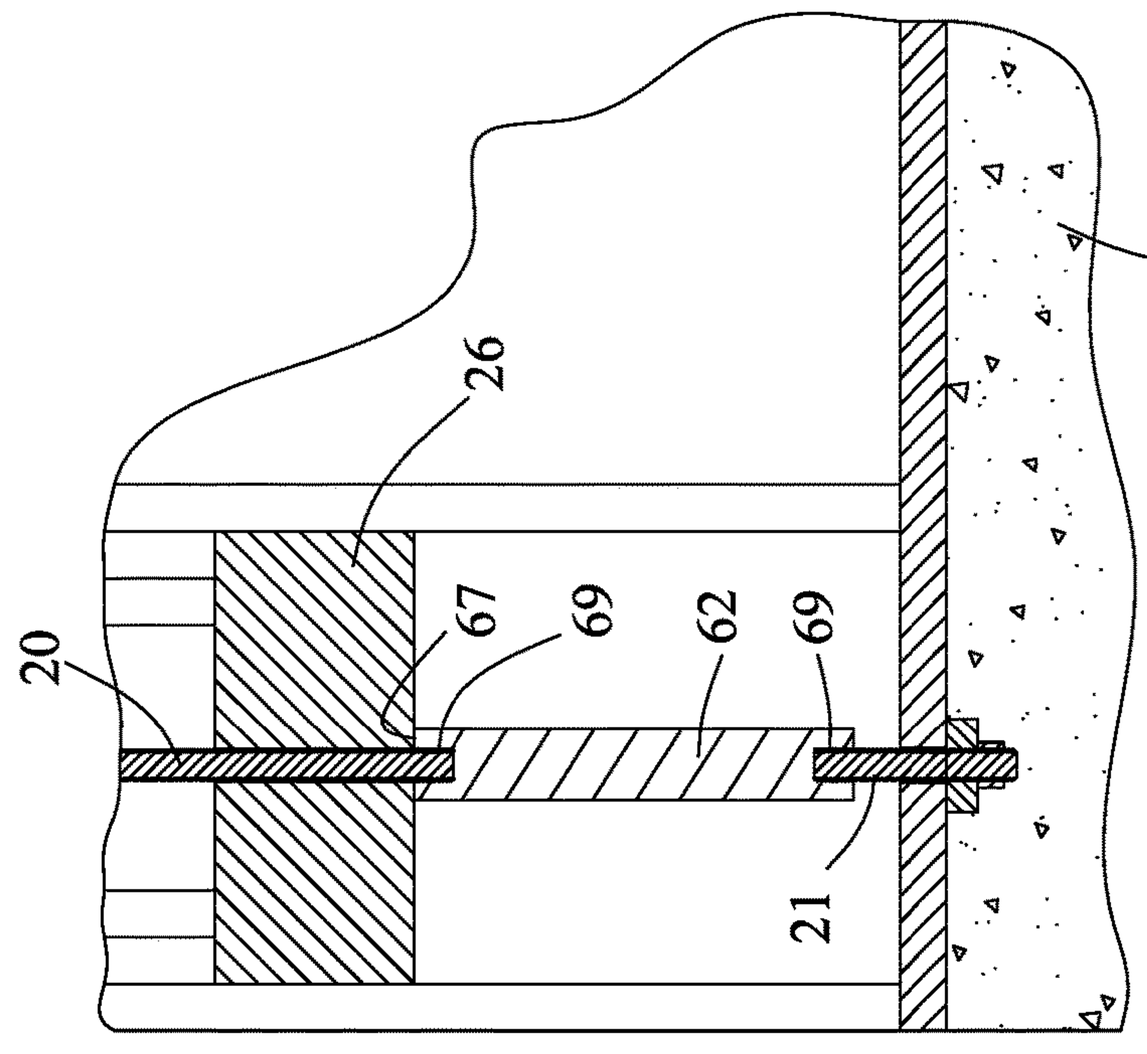


FIG. 35

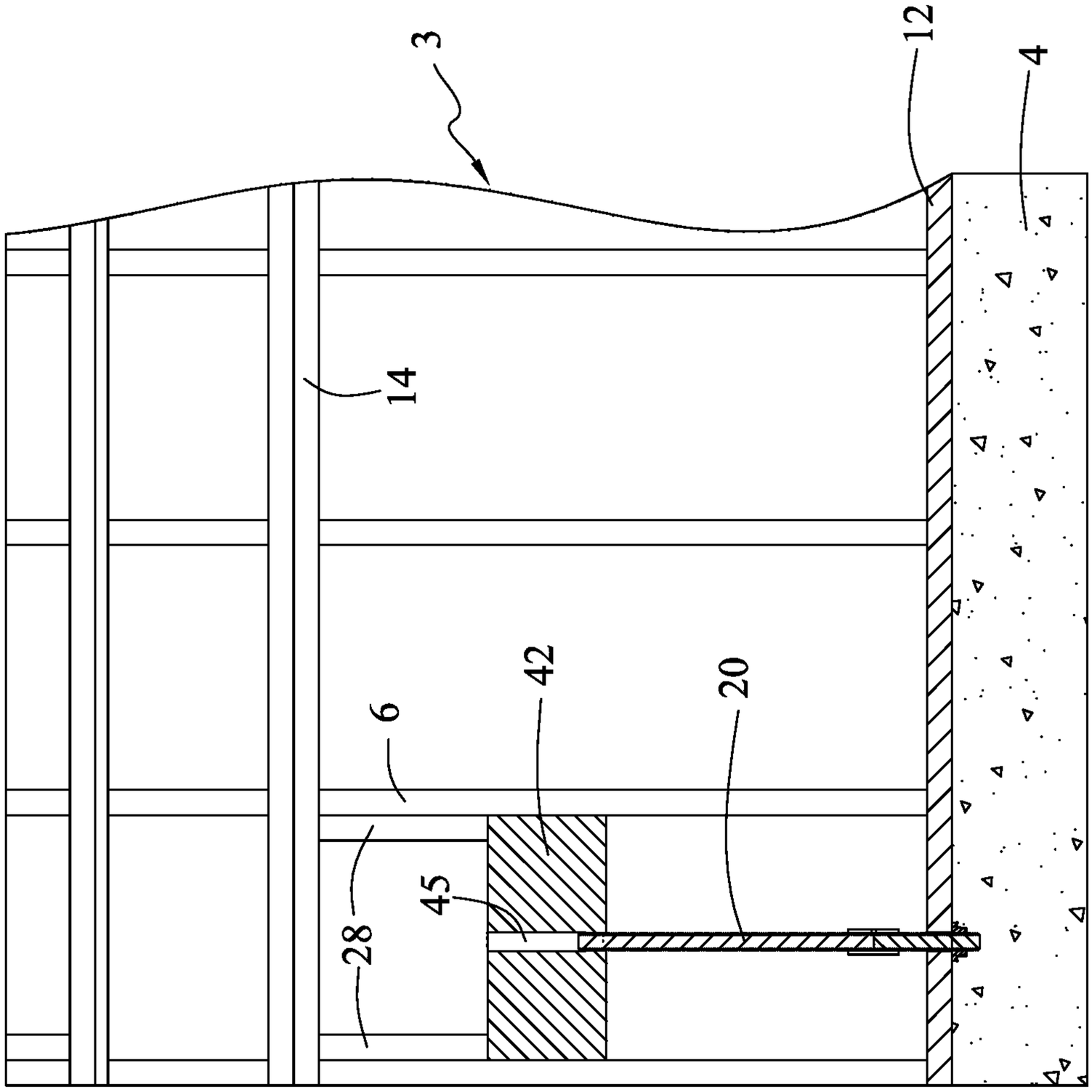
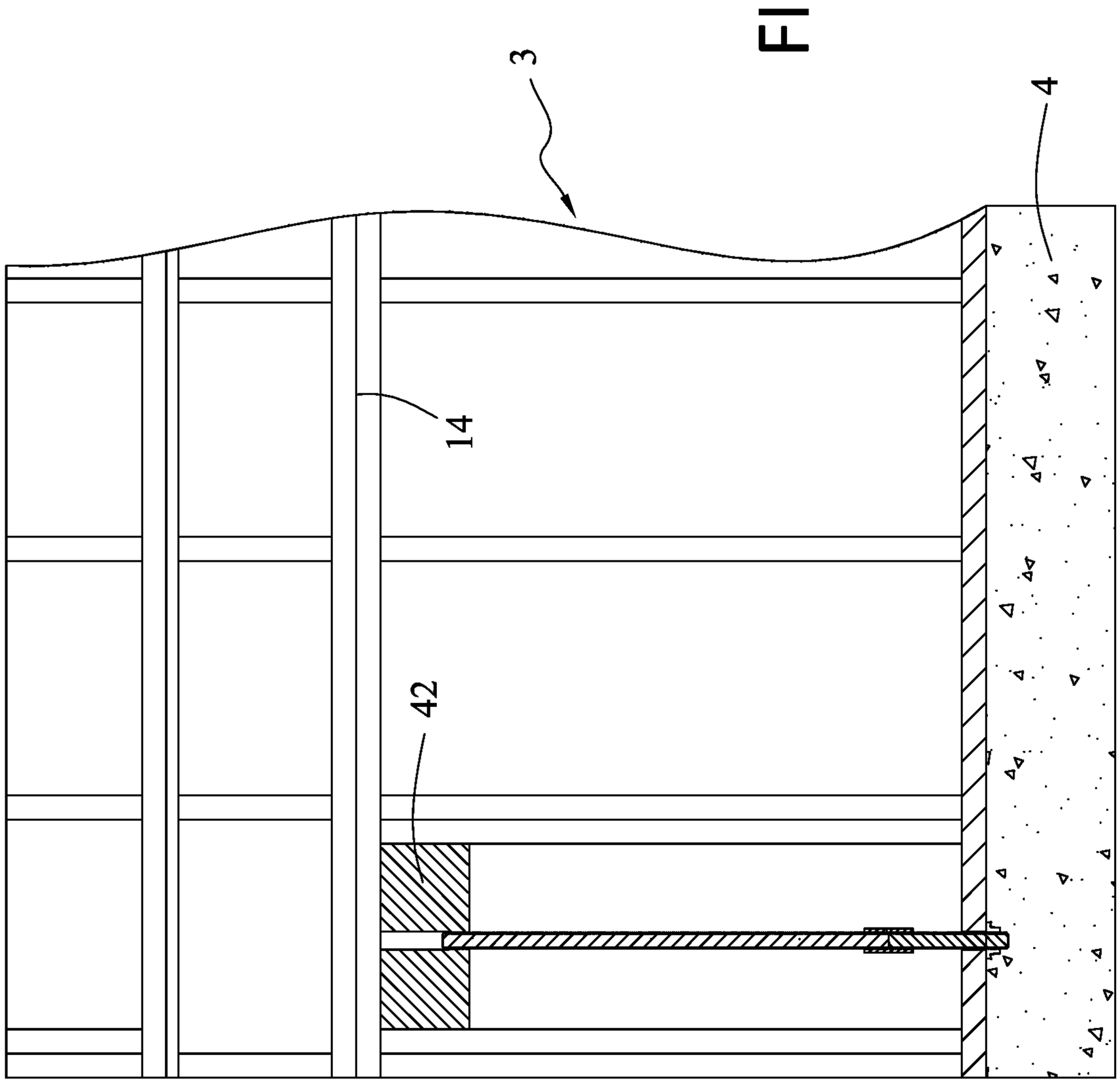


FIG. 37

FIG. 38



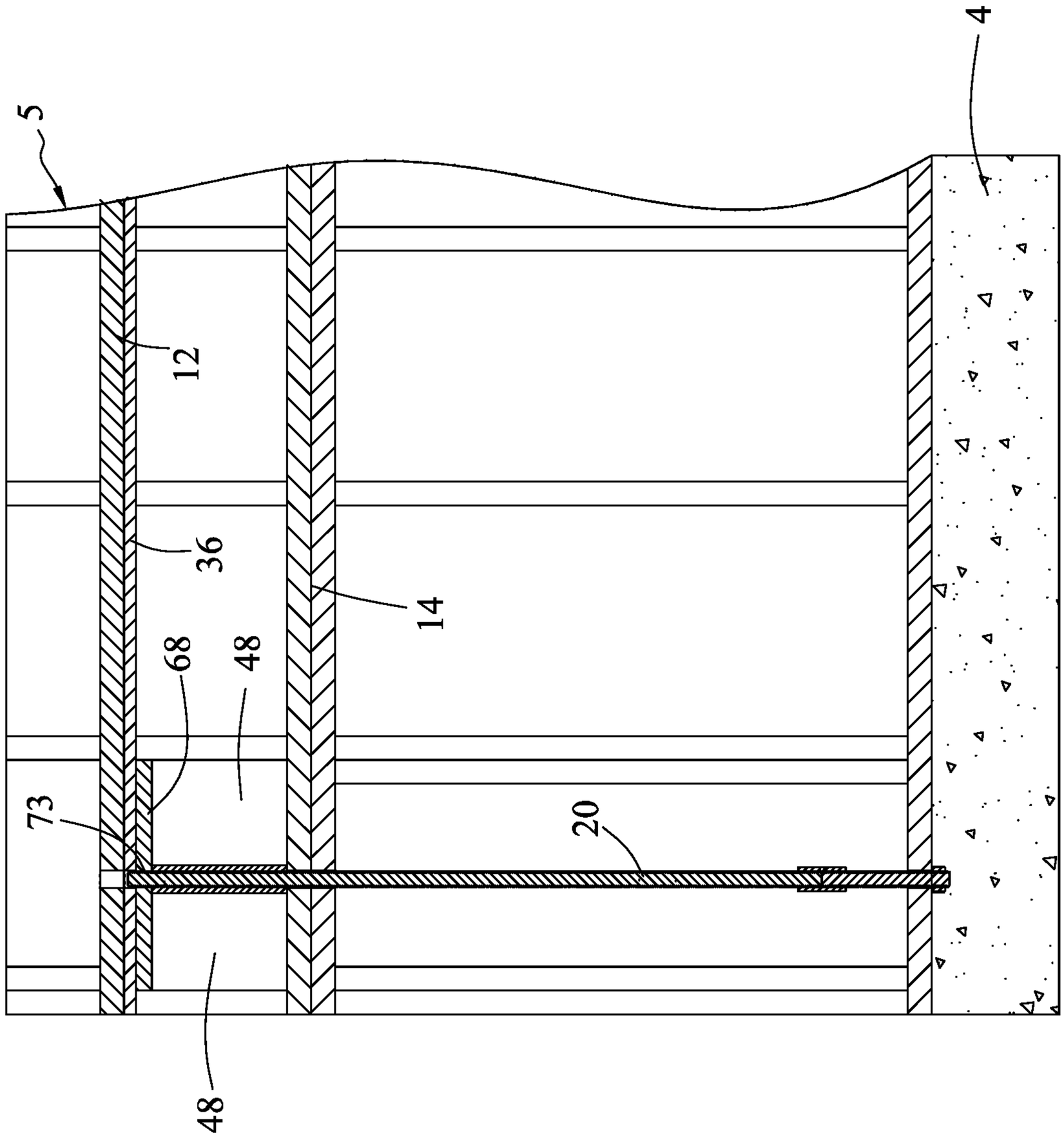


FIG. 39

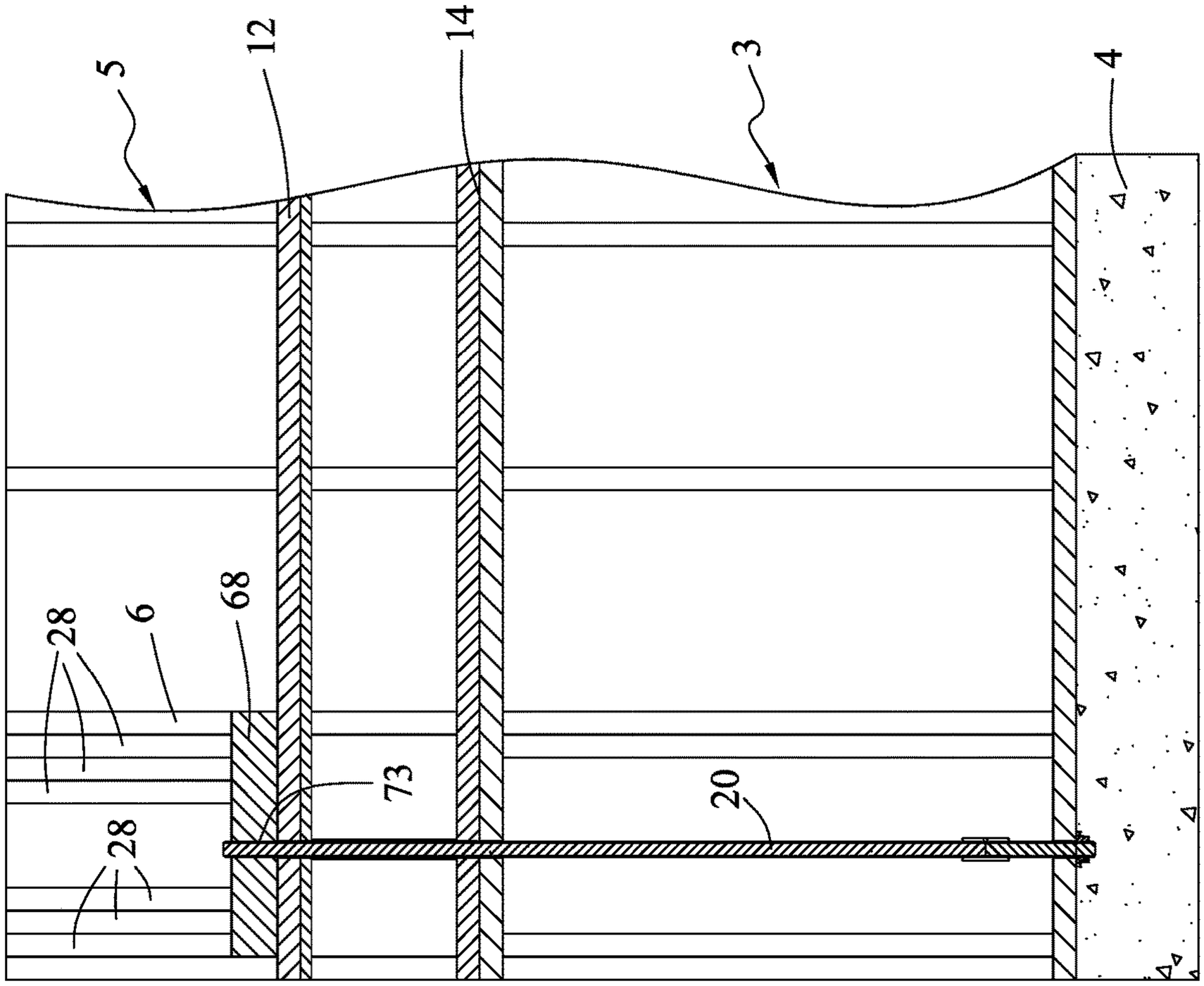


FIG. 40

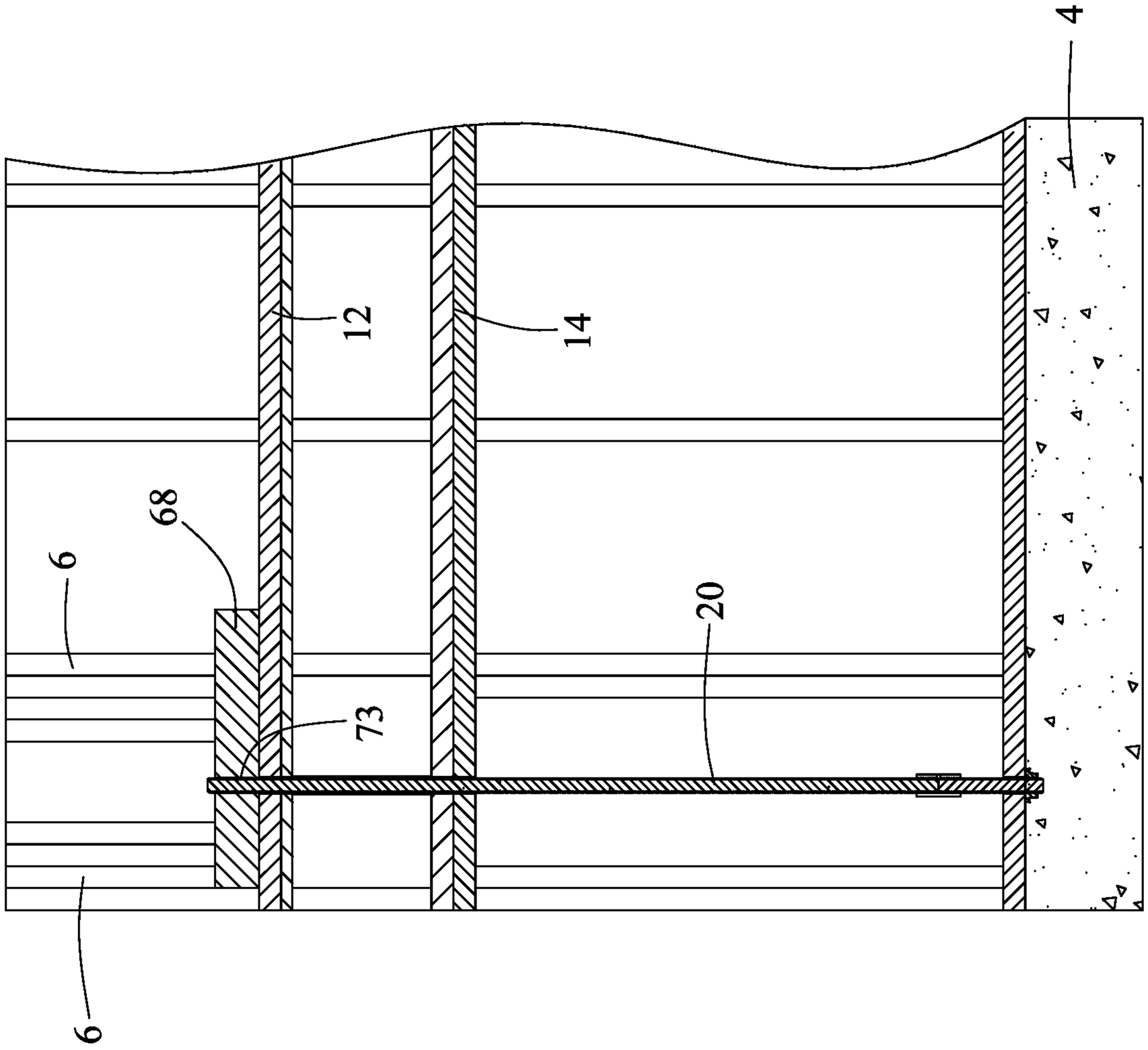
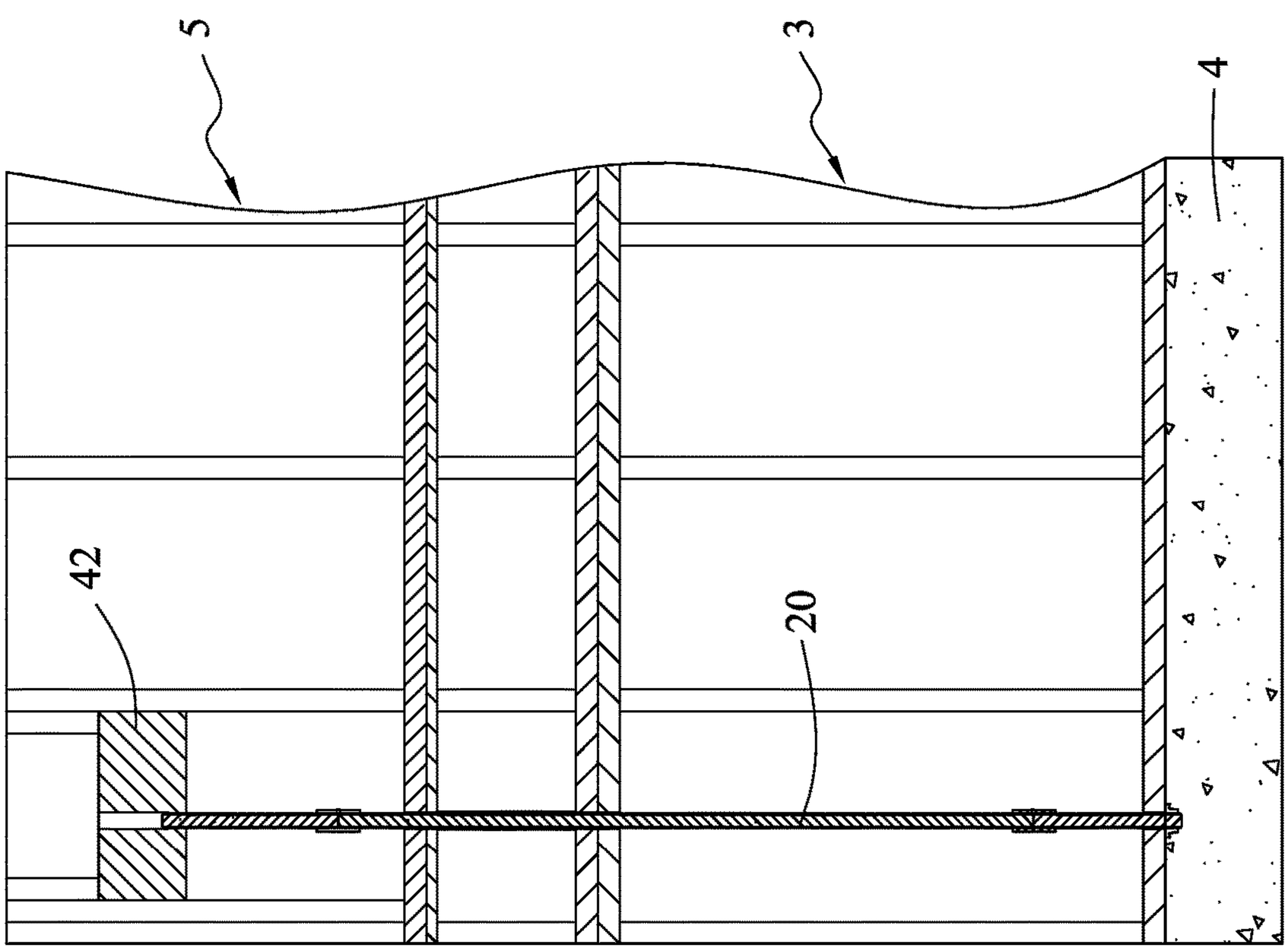


FIG. 41



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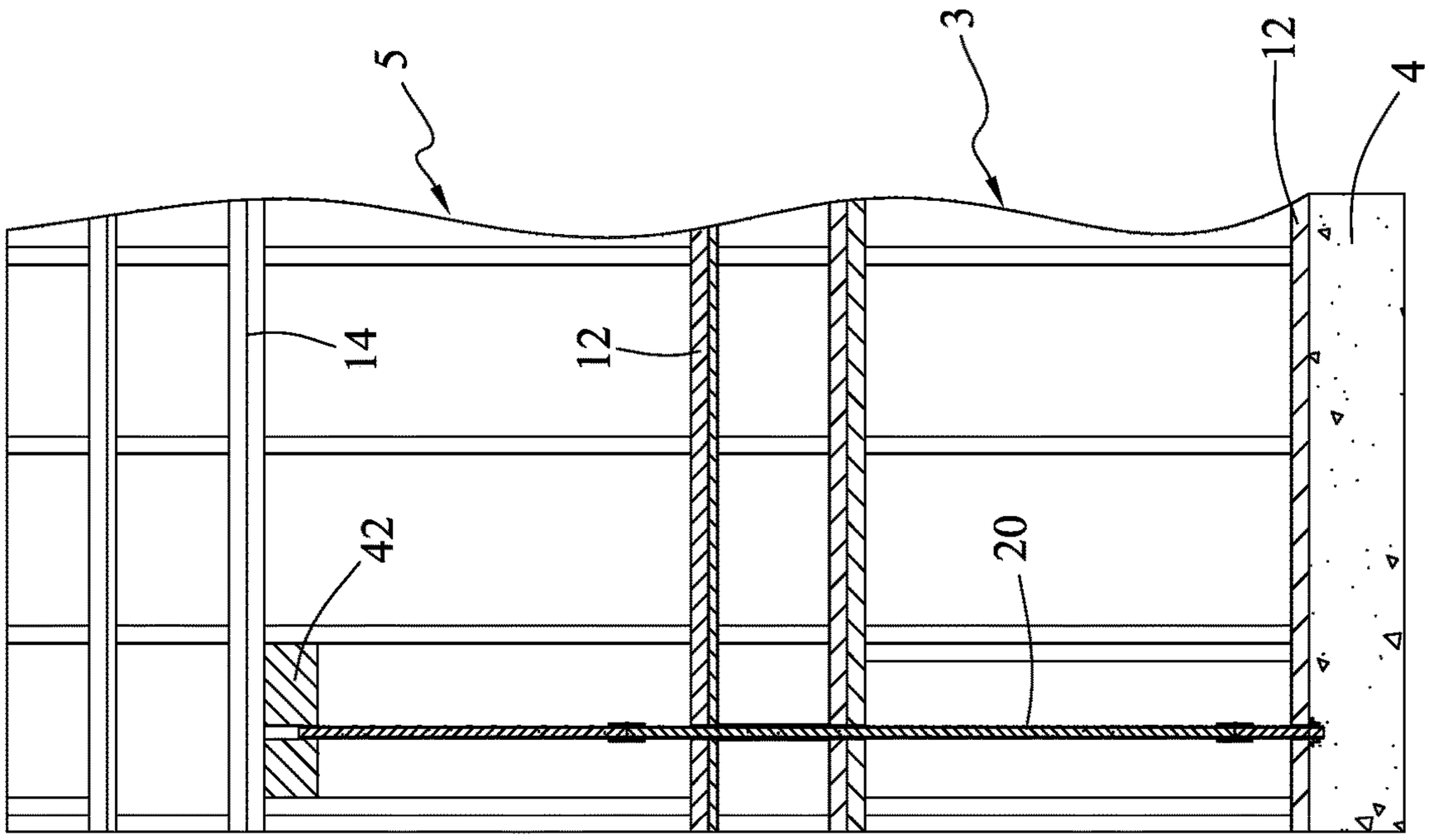
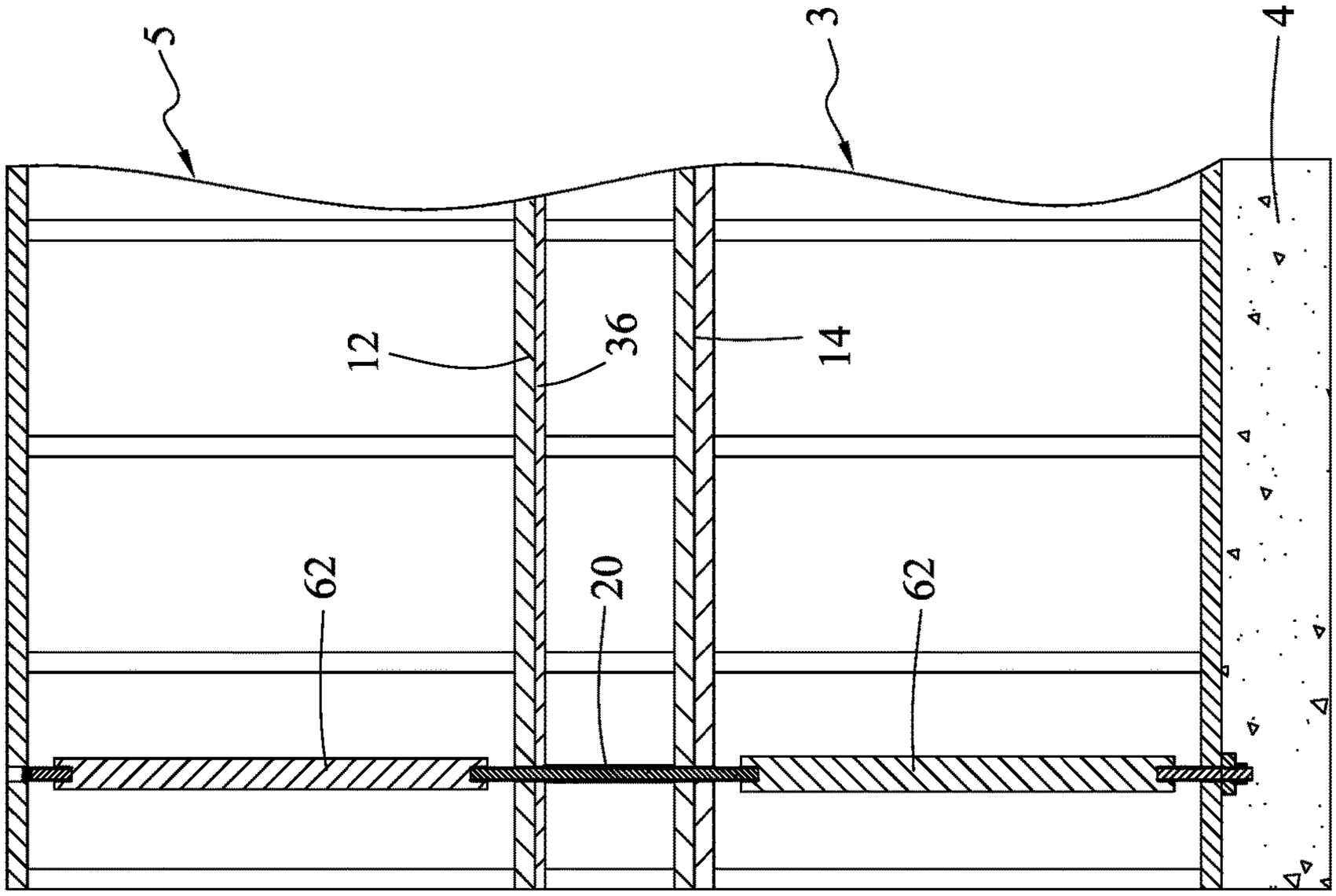


FIG. 43



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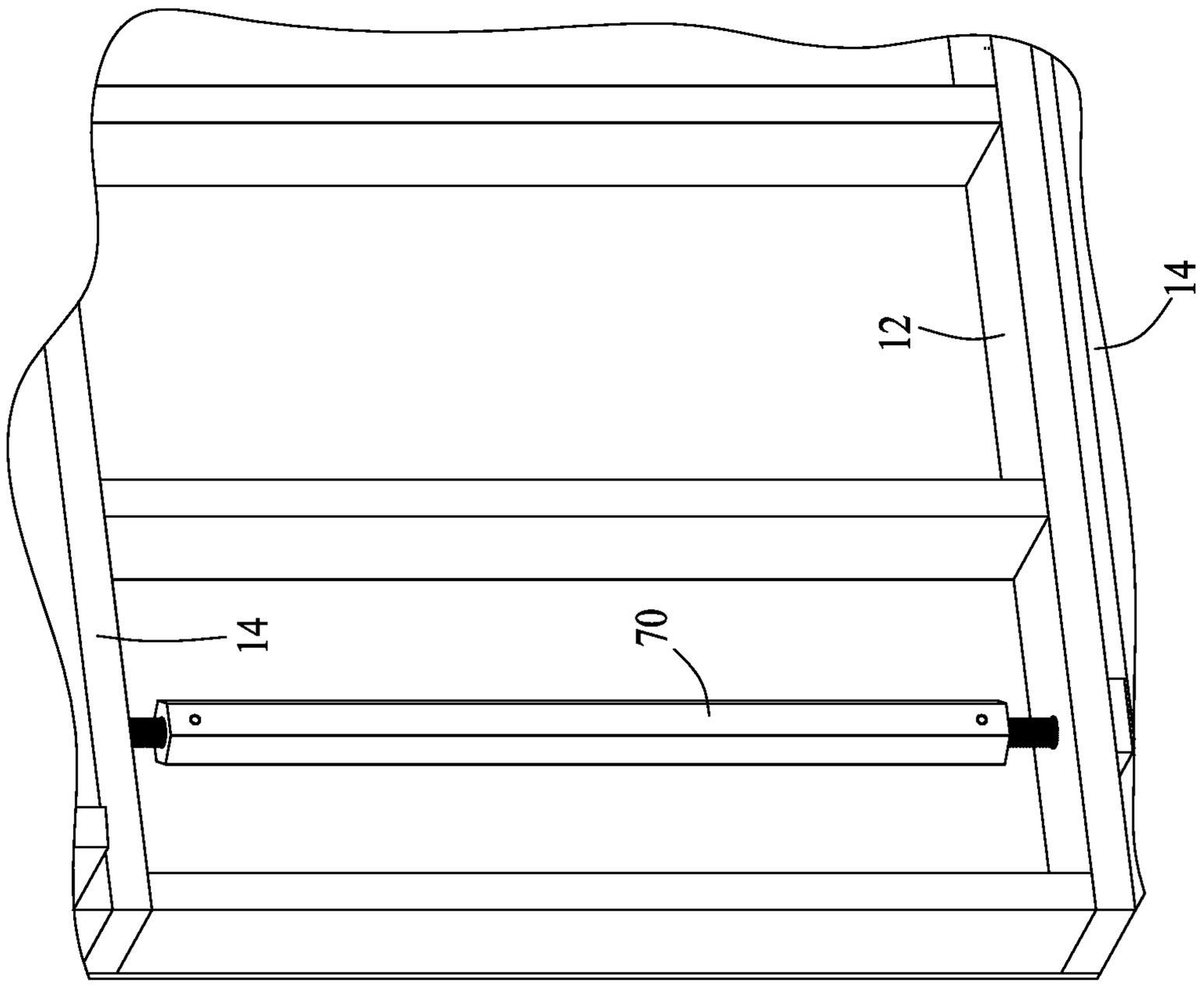

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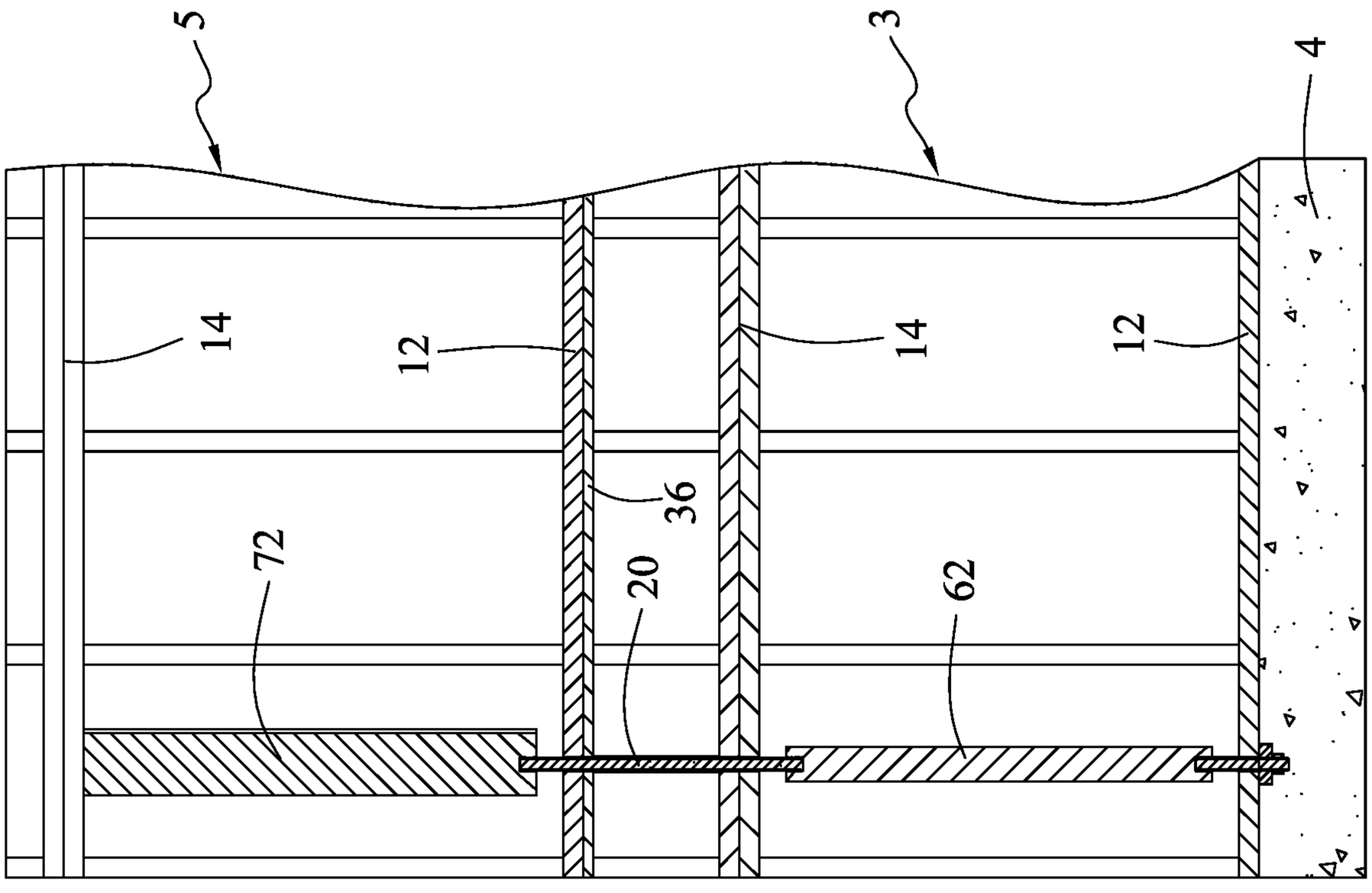

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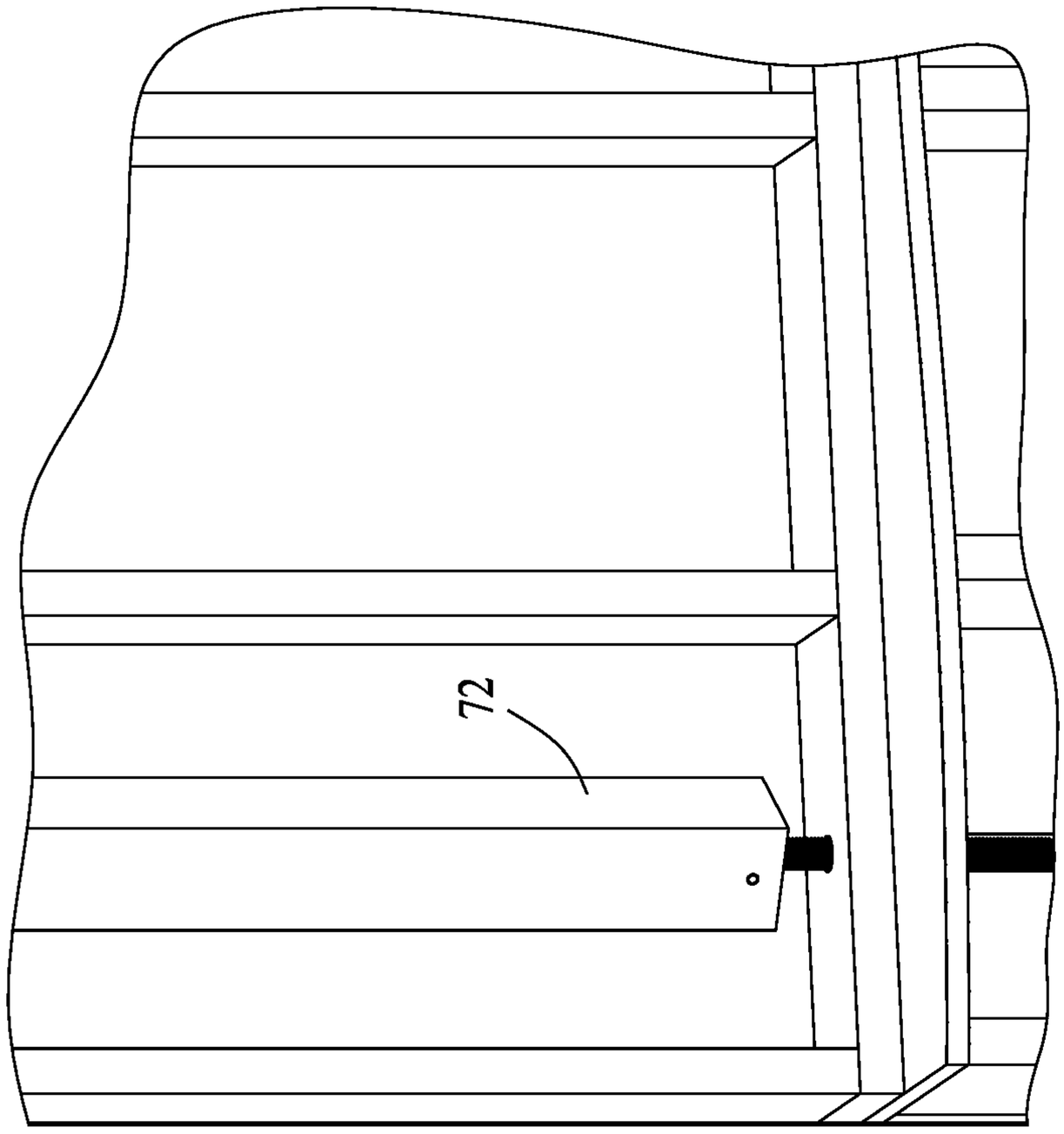


FIG. 47

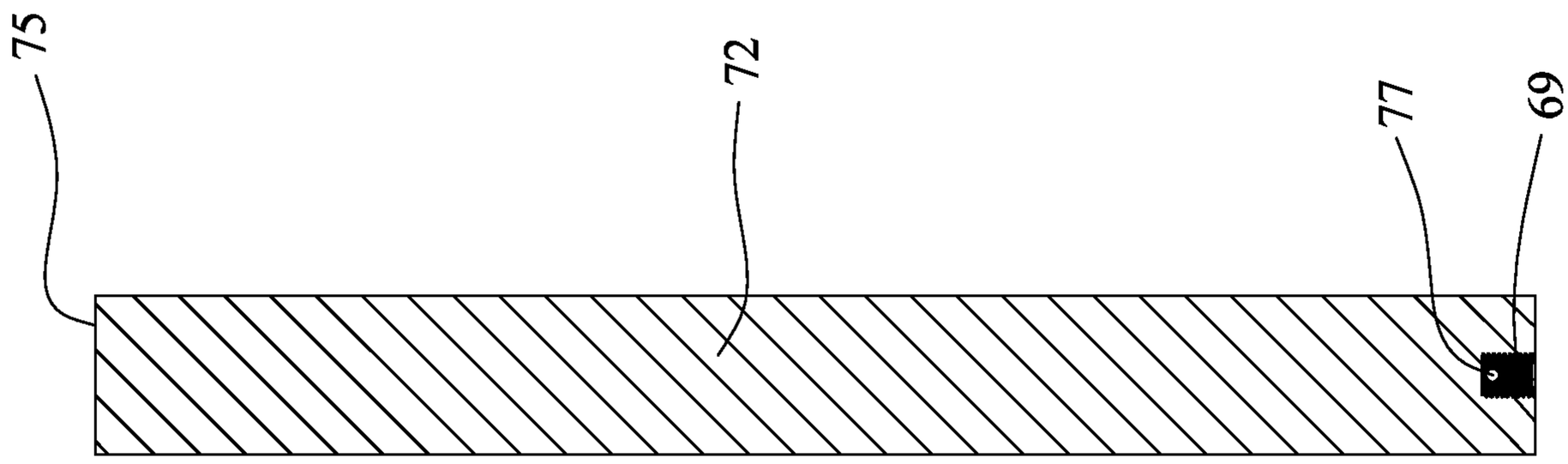


FIG. 48

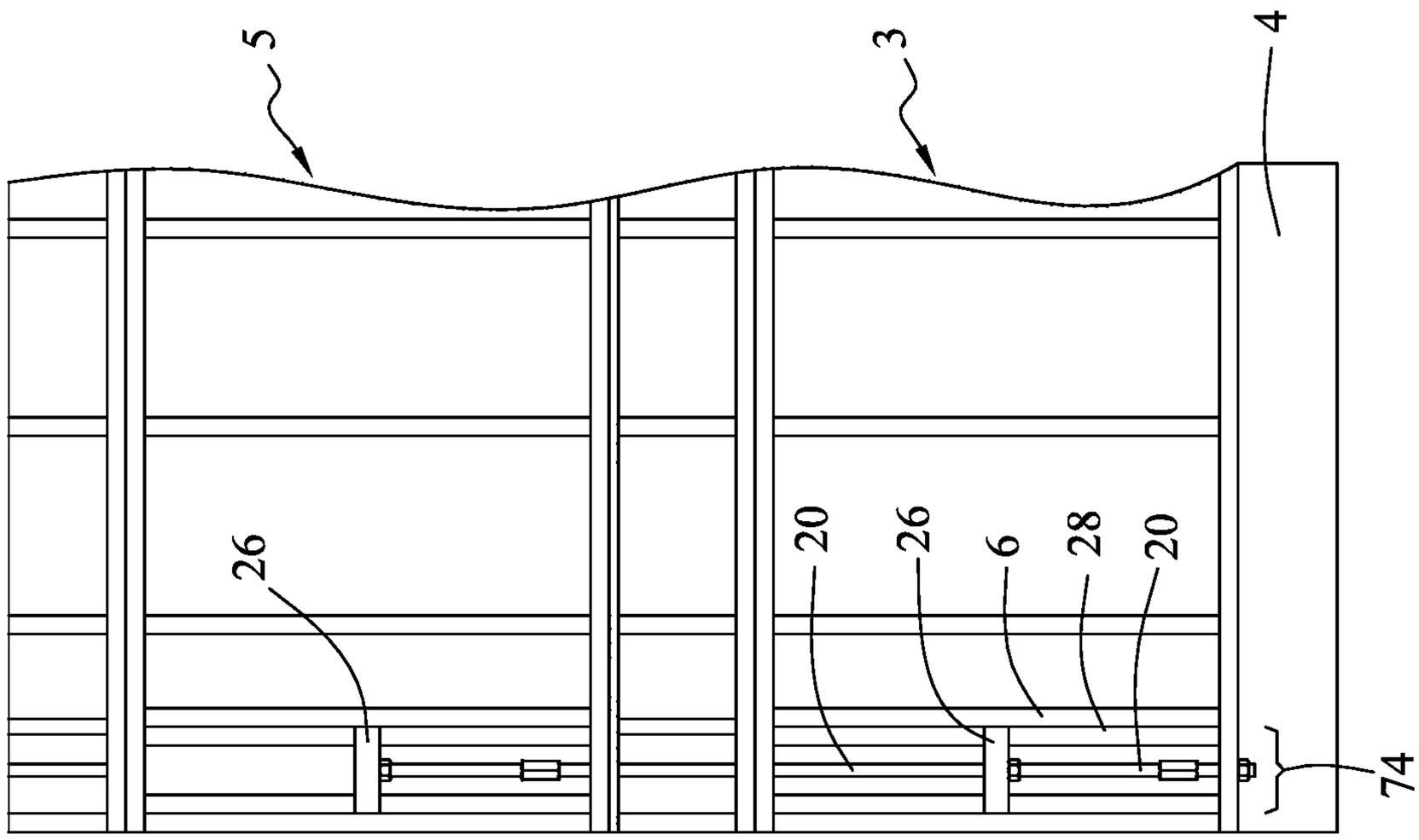


FIG. 49

FIG. 50

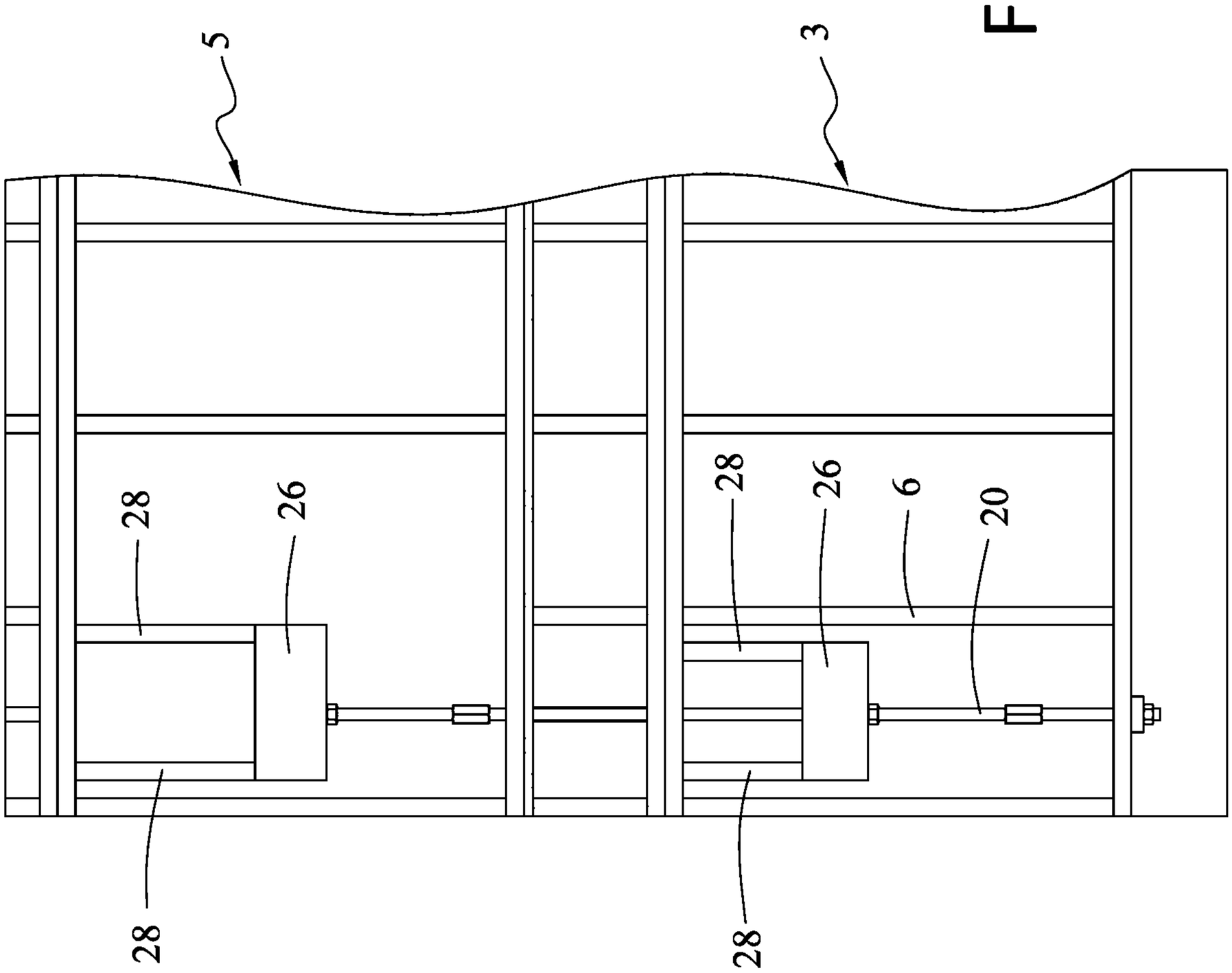
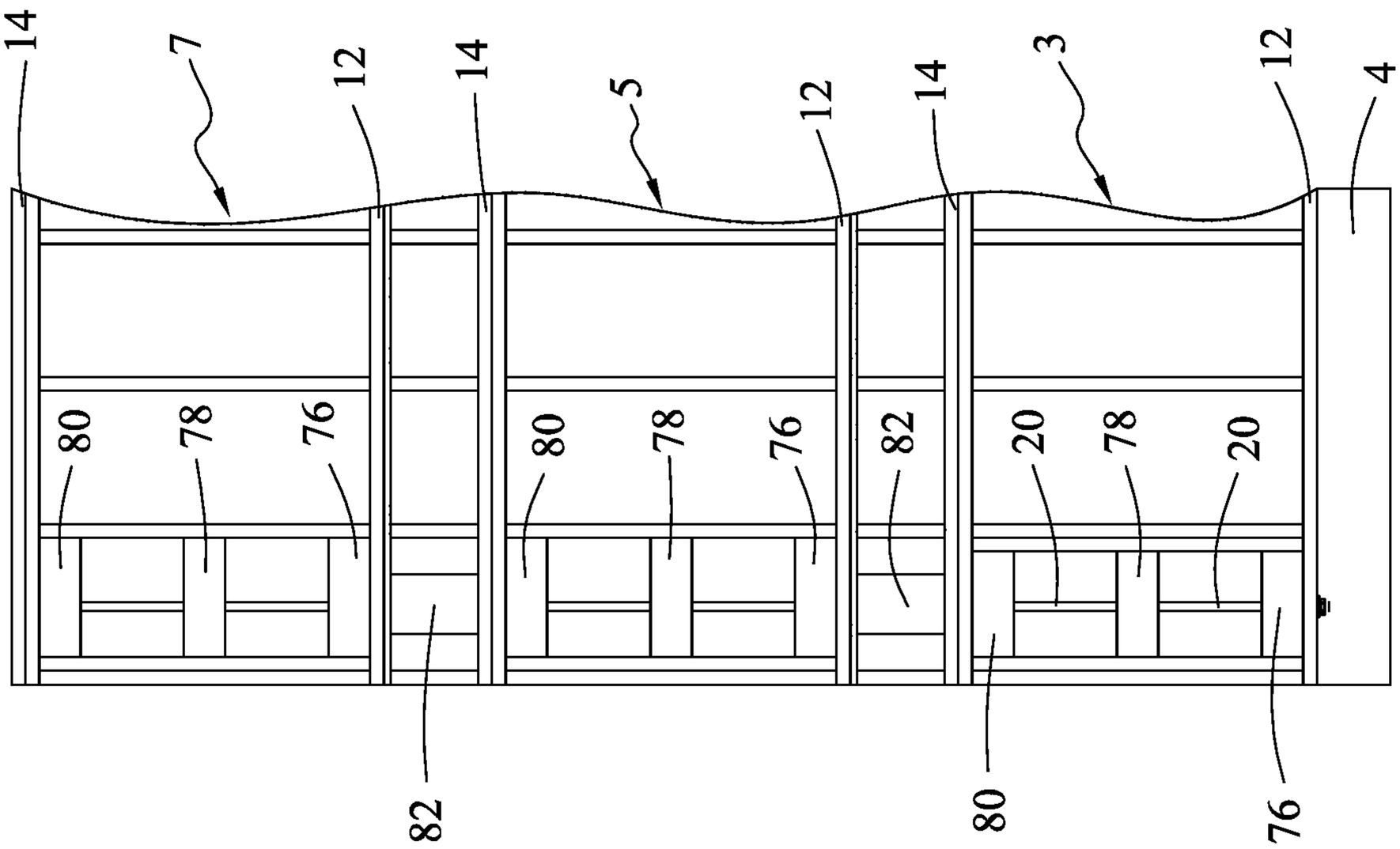


FIG. 51



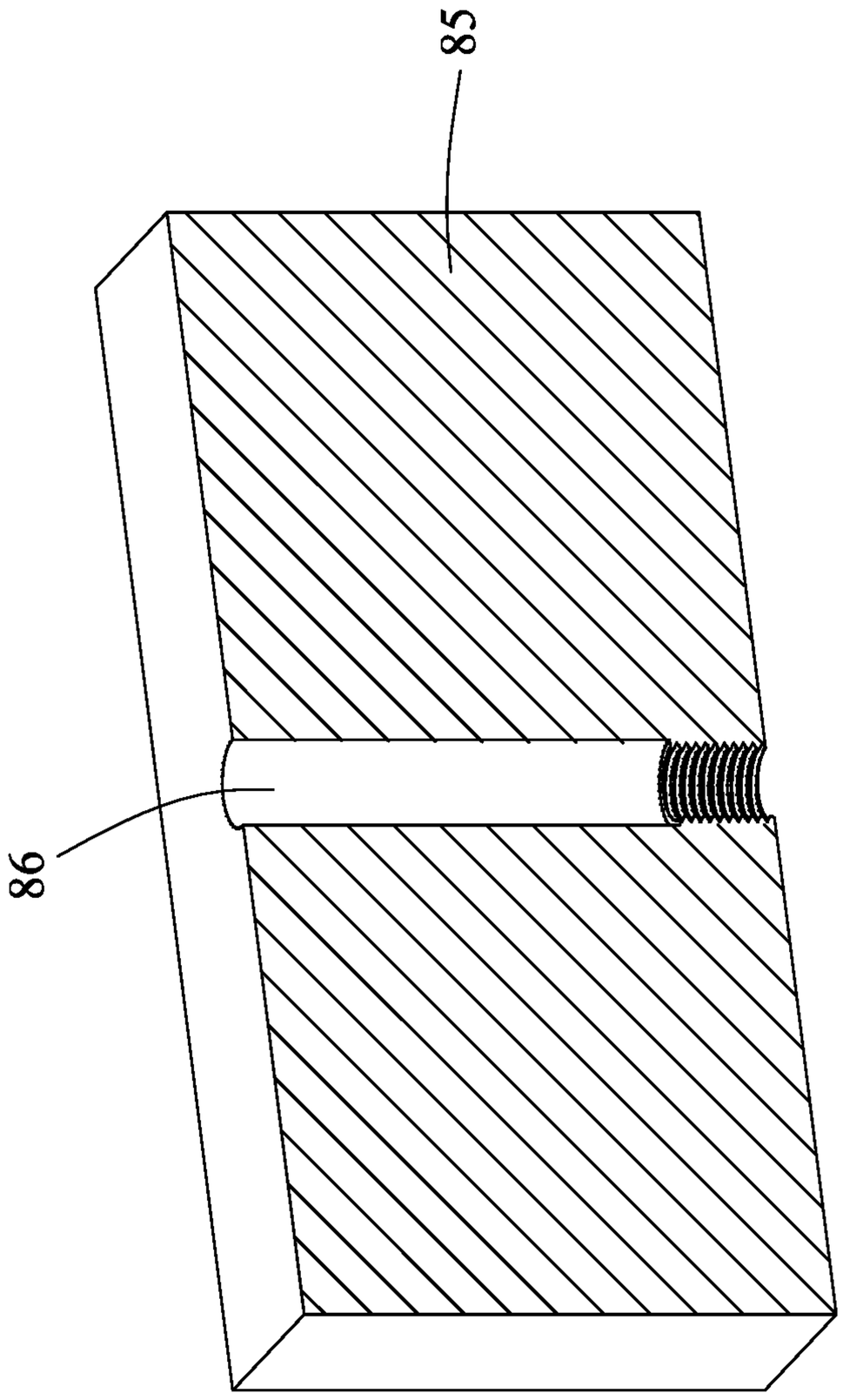


FIG. 52

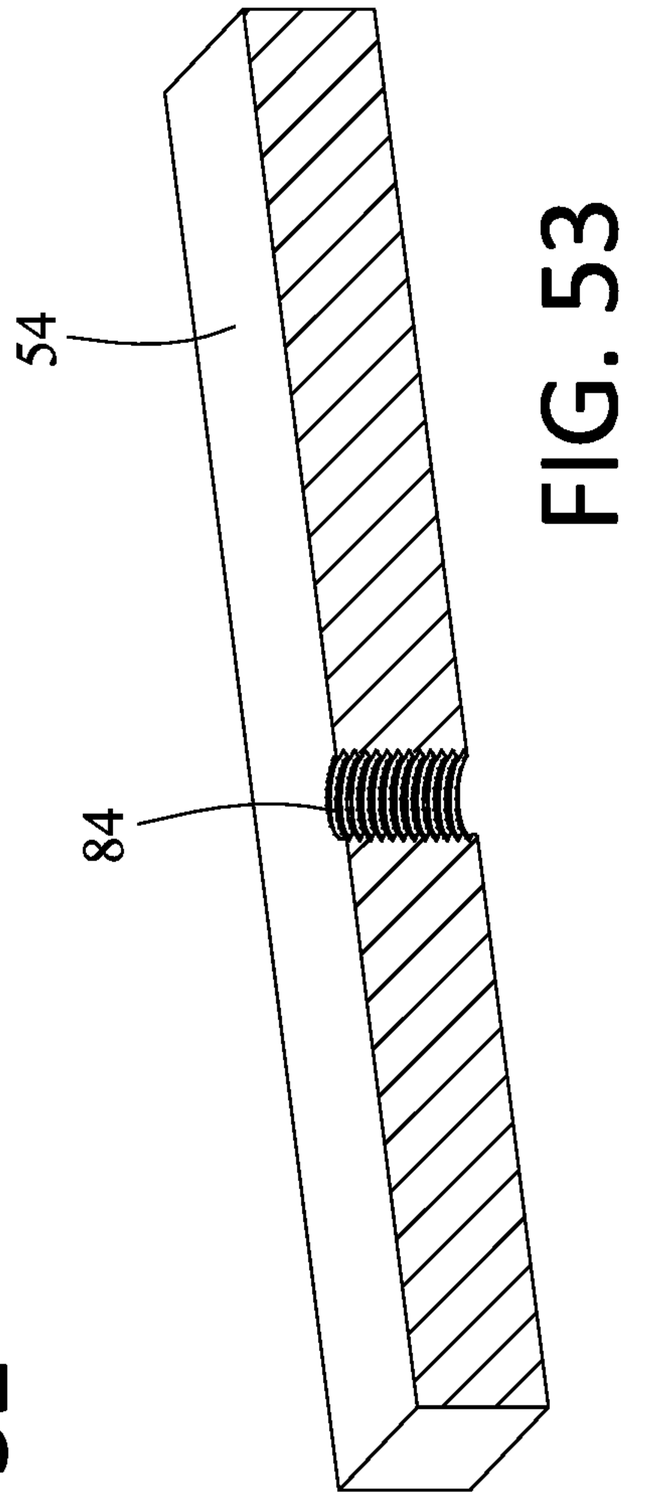


FIG. 53

FIG. 54

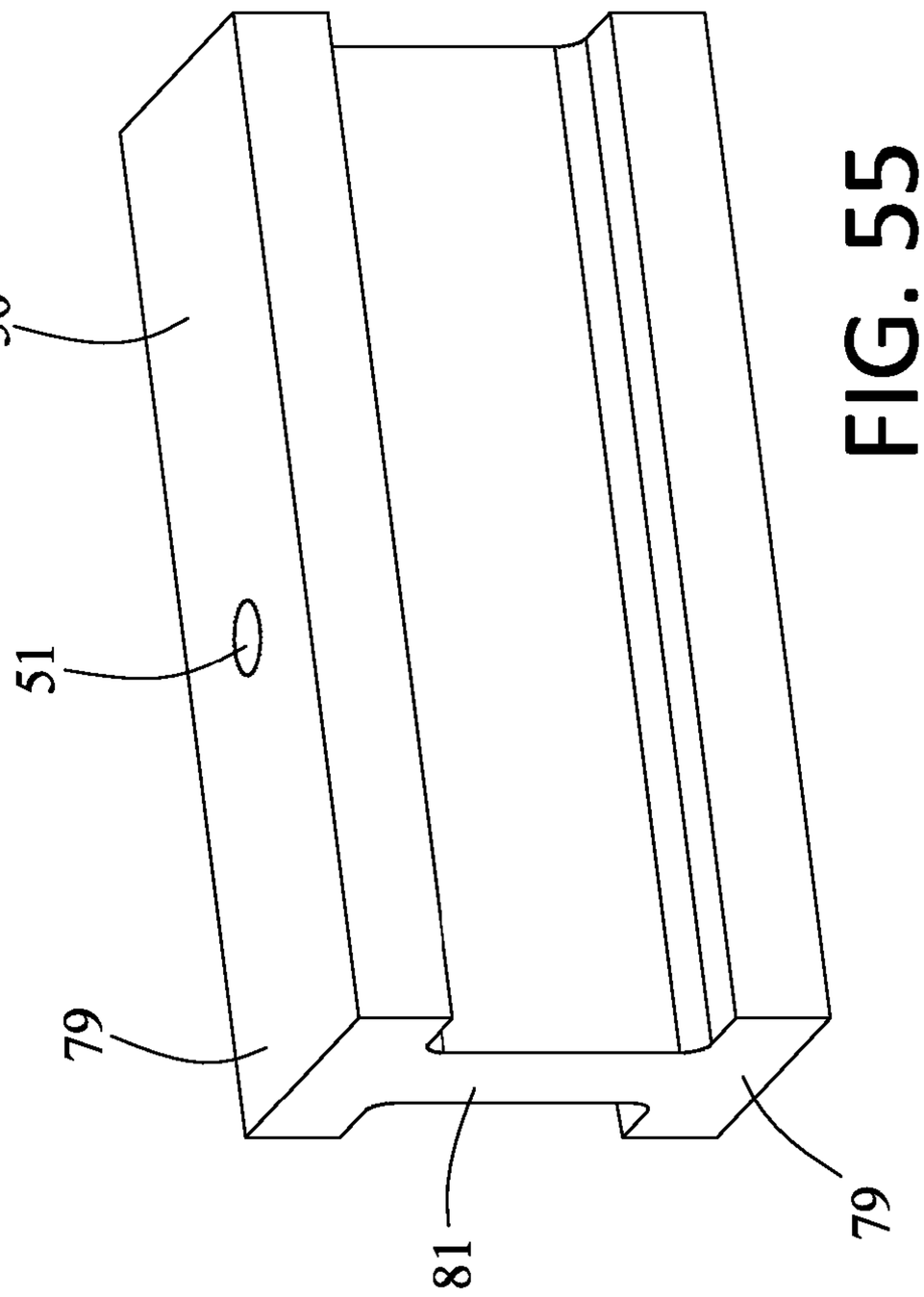


FIG. 55

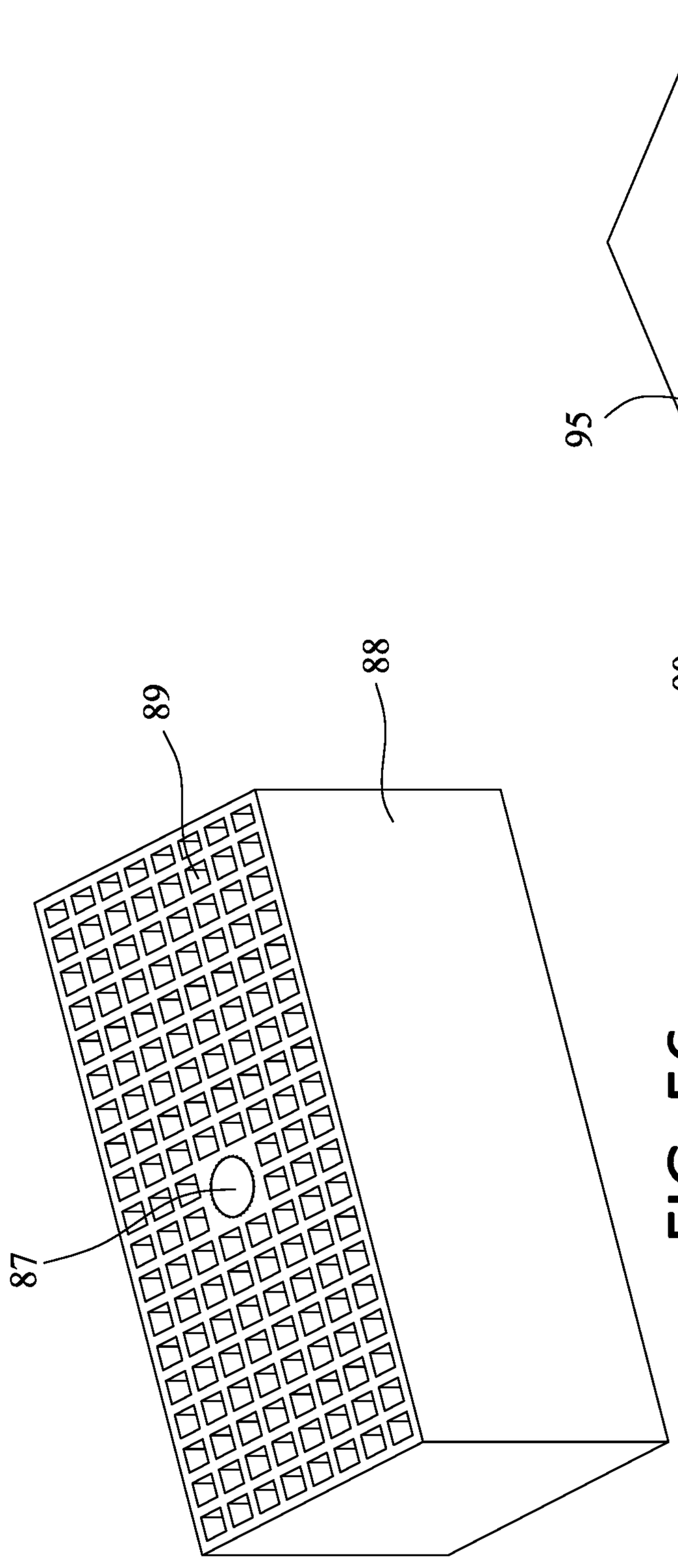


FIG. 56

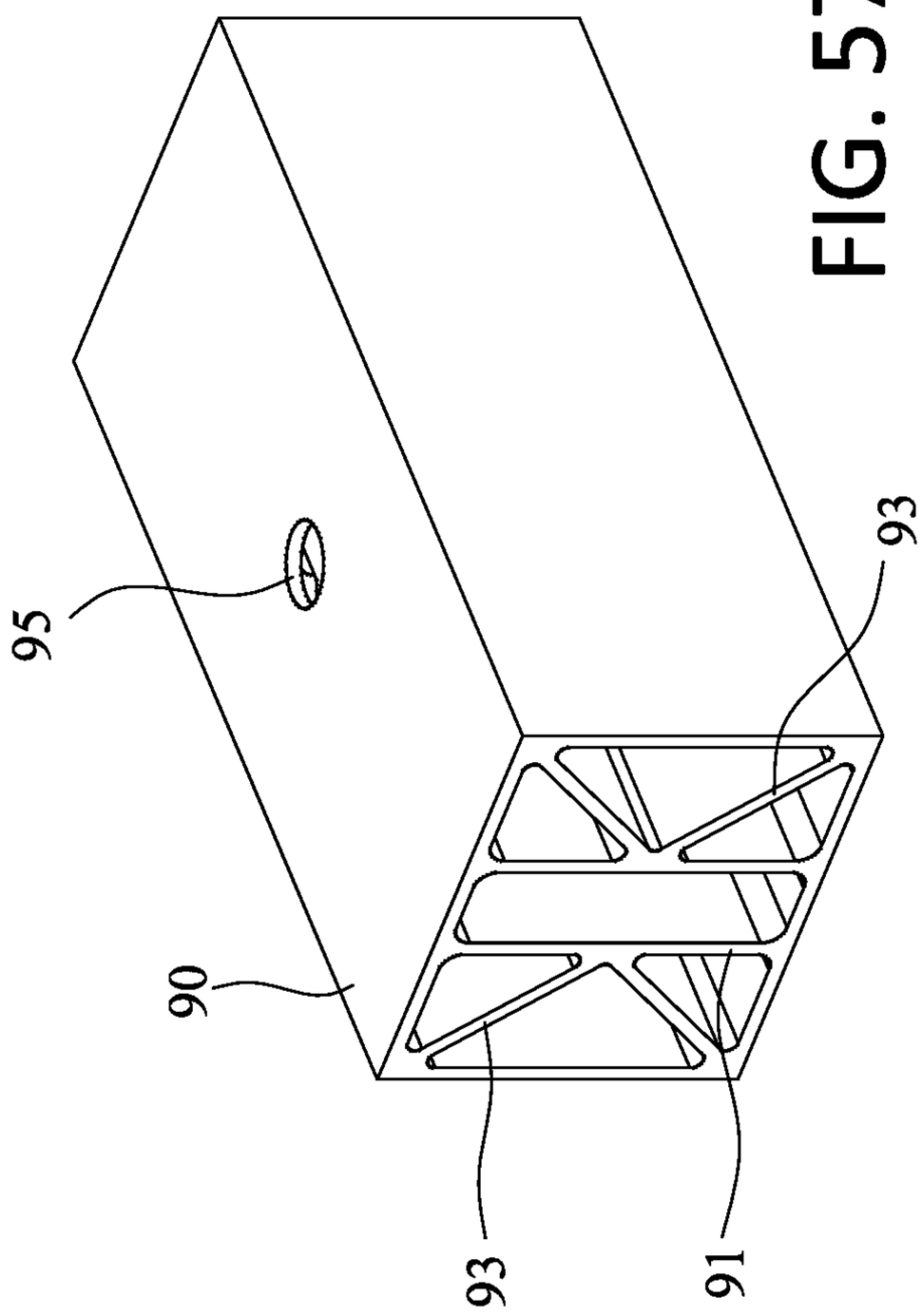


FIG. 57

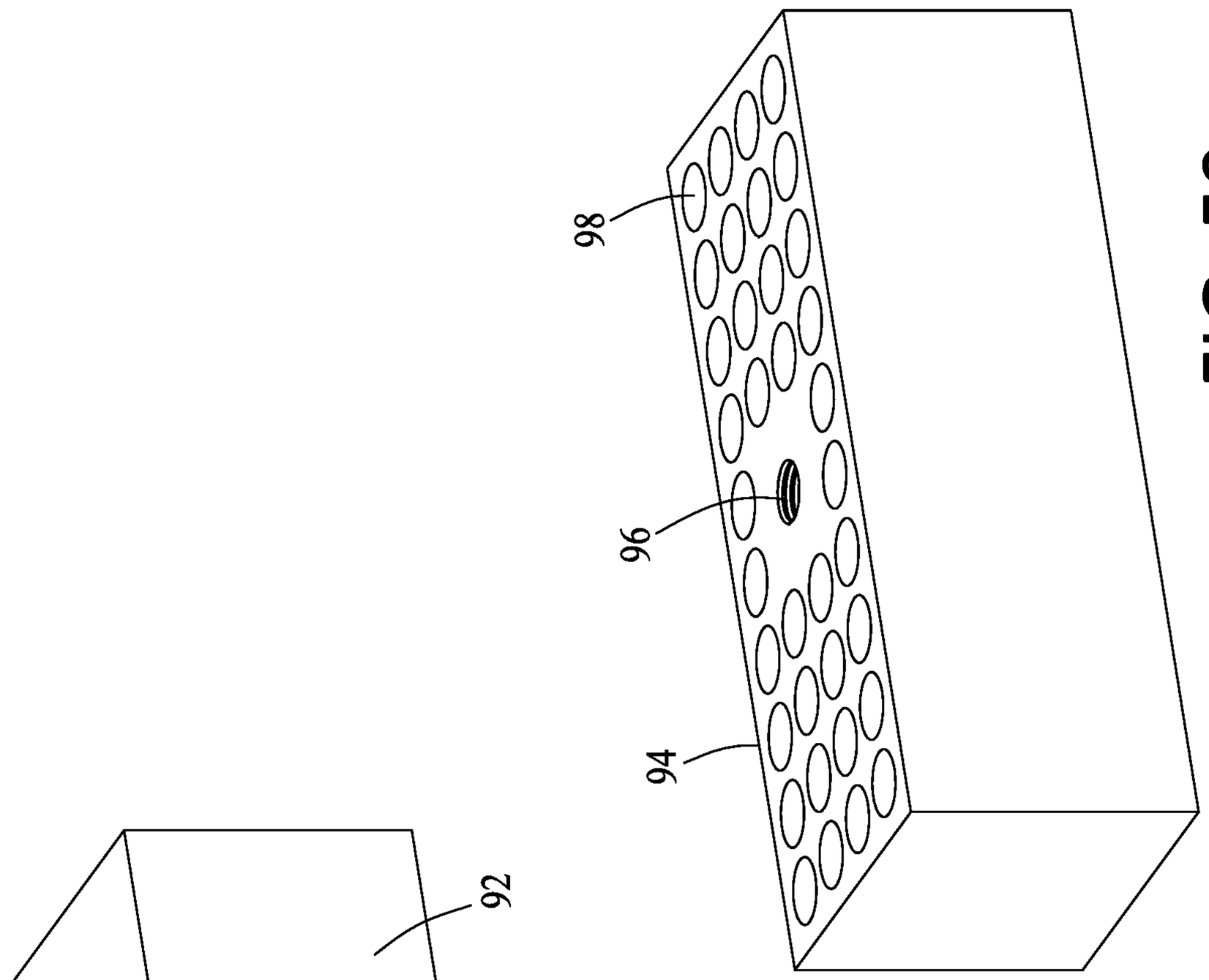


FIG. 59

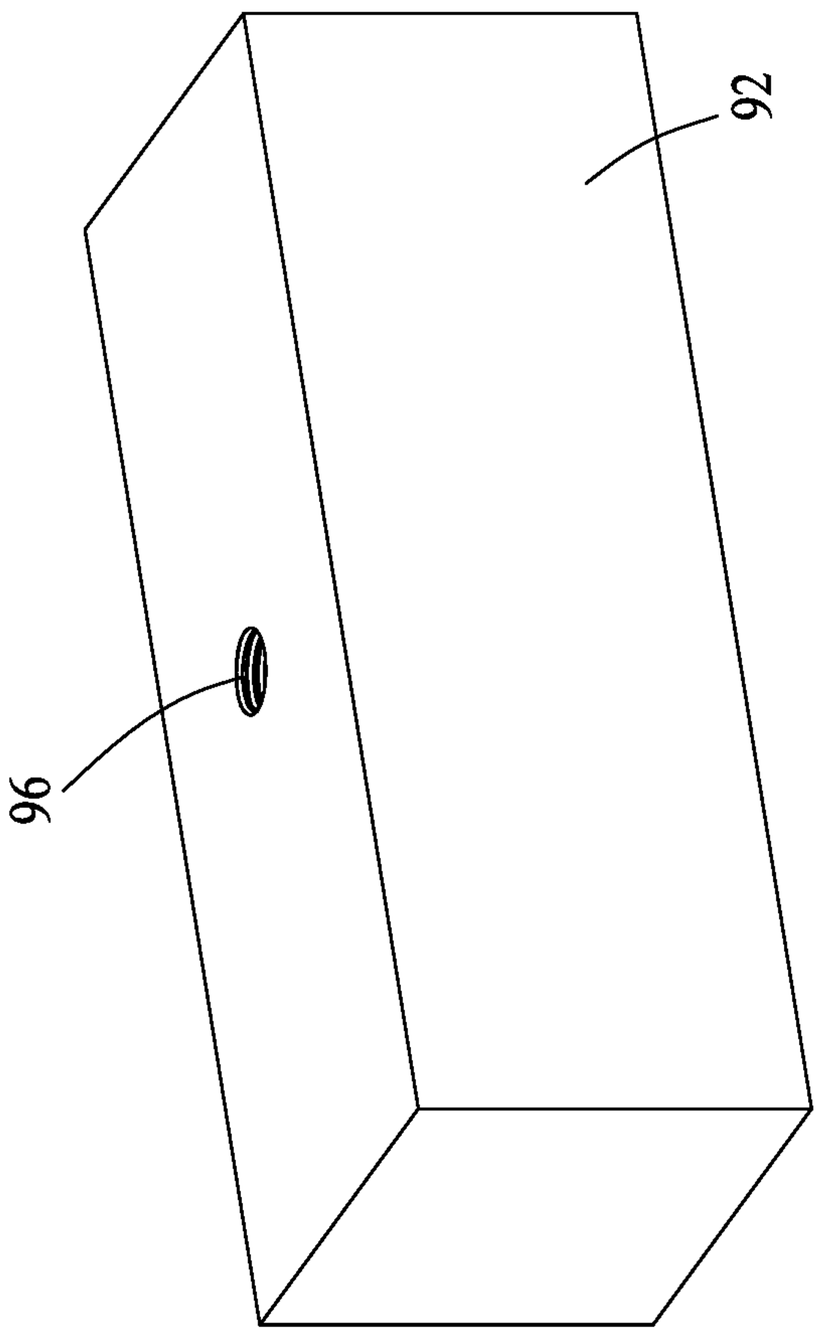


FIG. 58

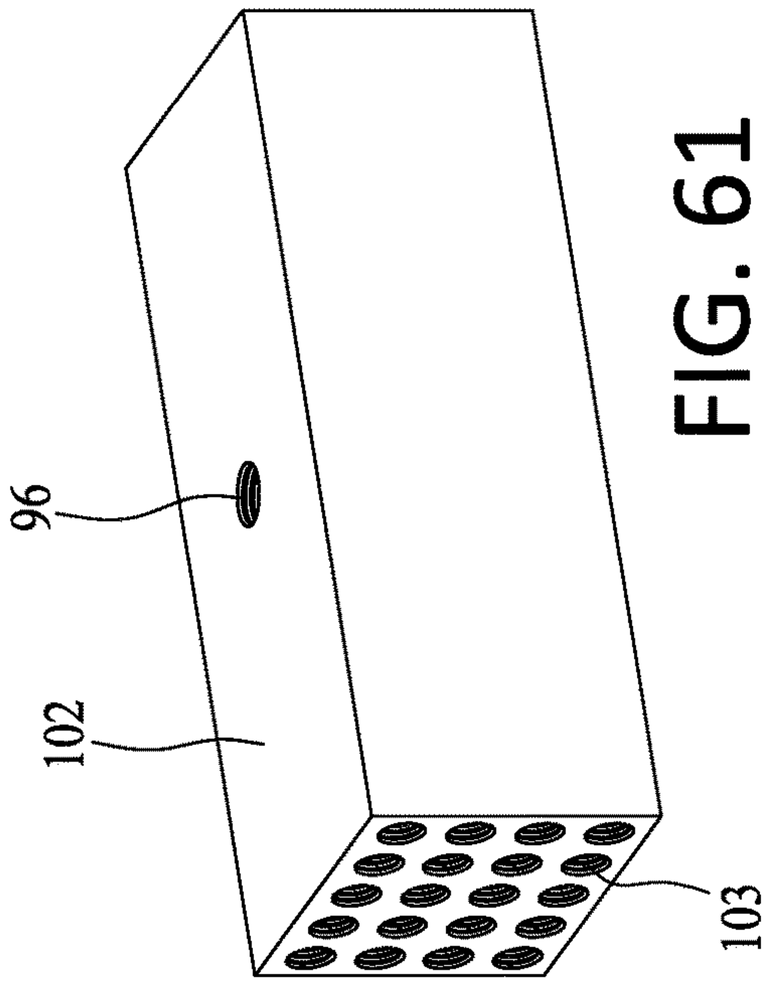


FIG. 61

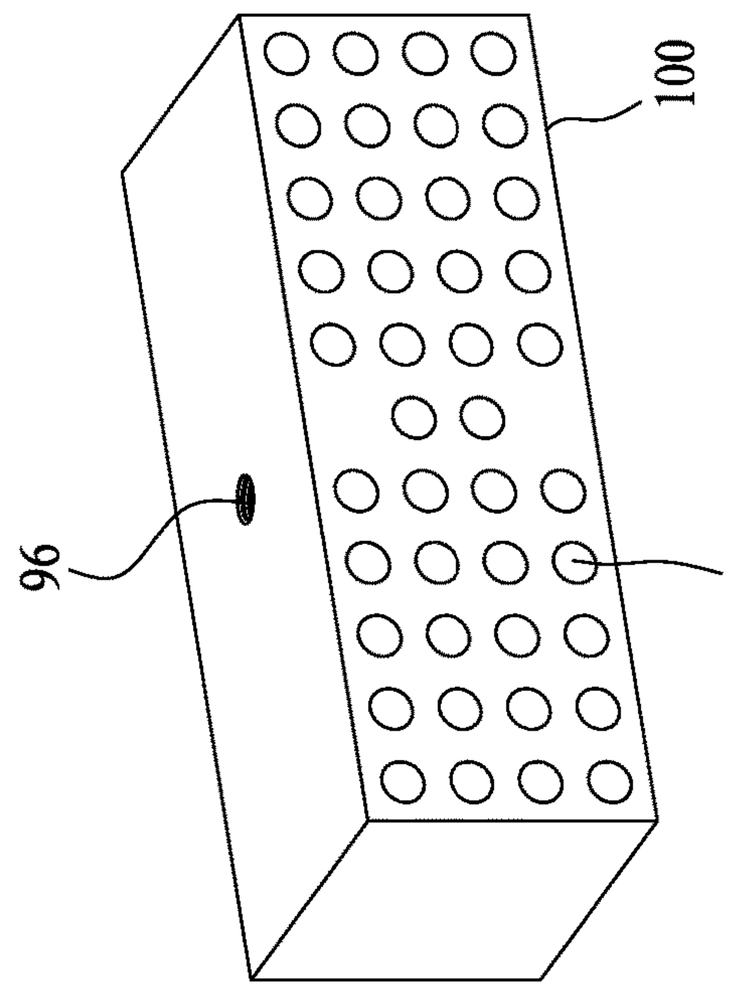


FIG. 60

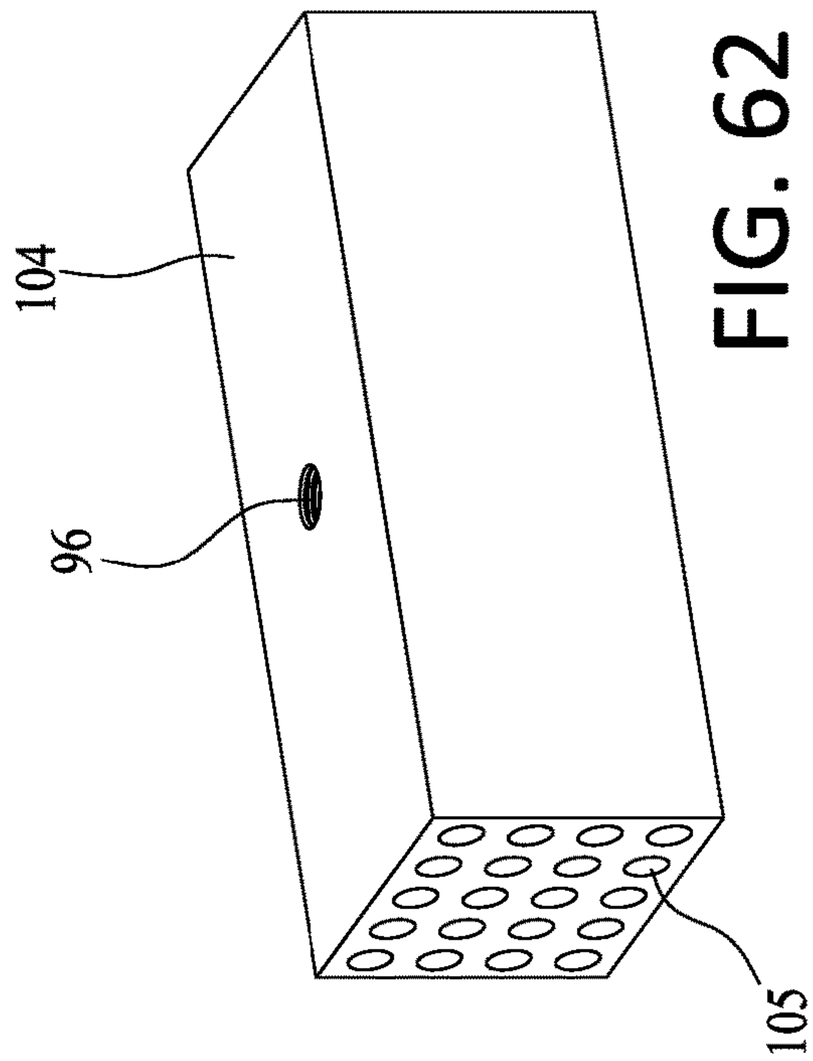


FIG. 62

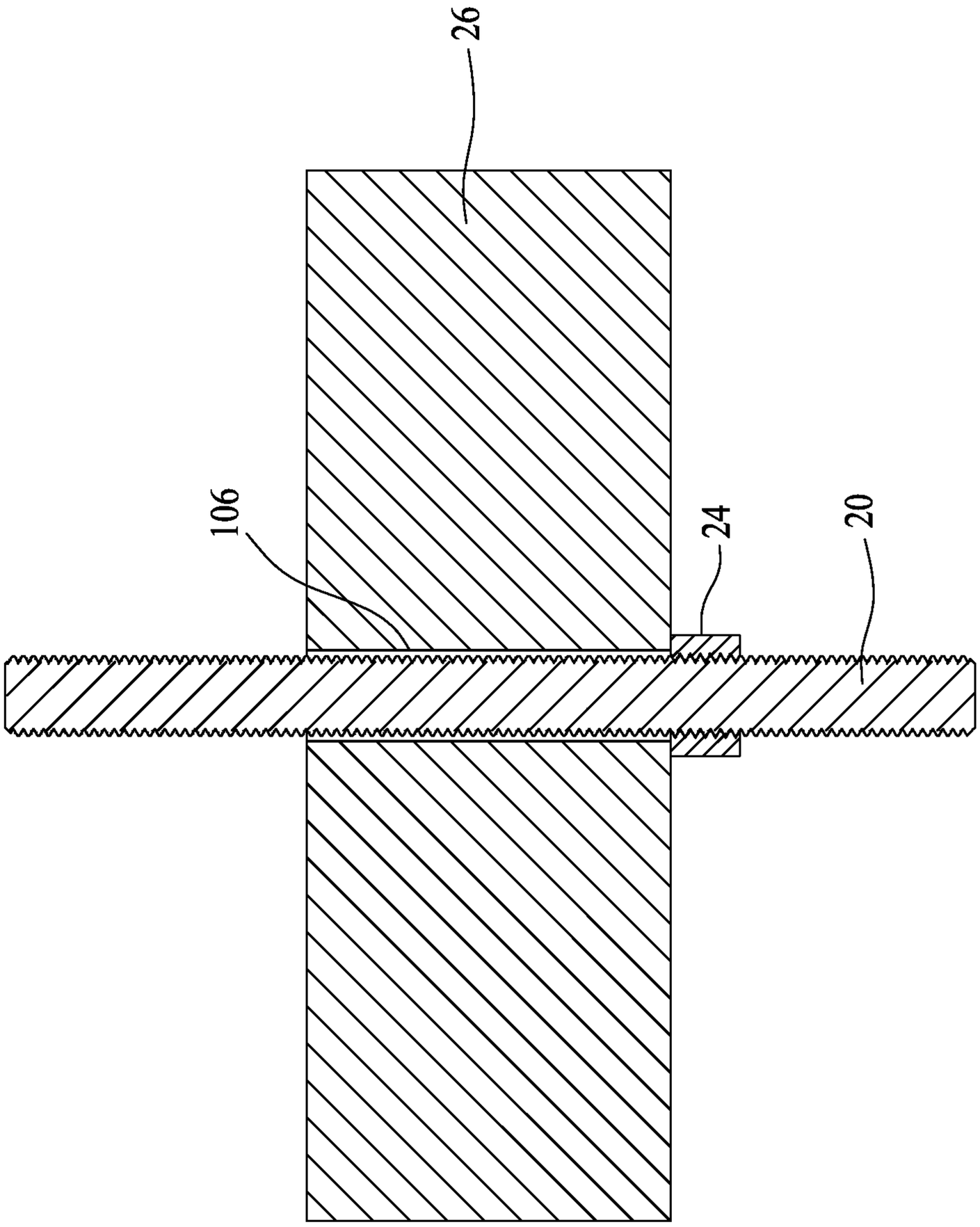


FIG. 63

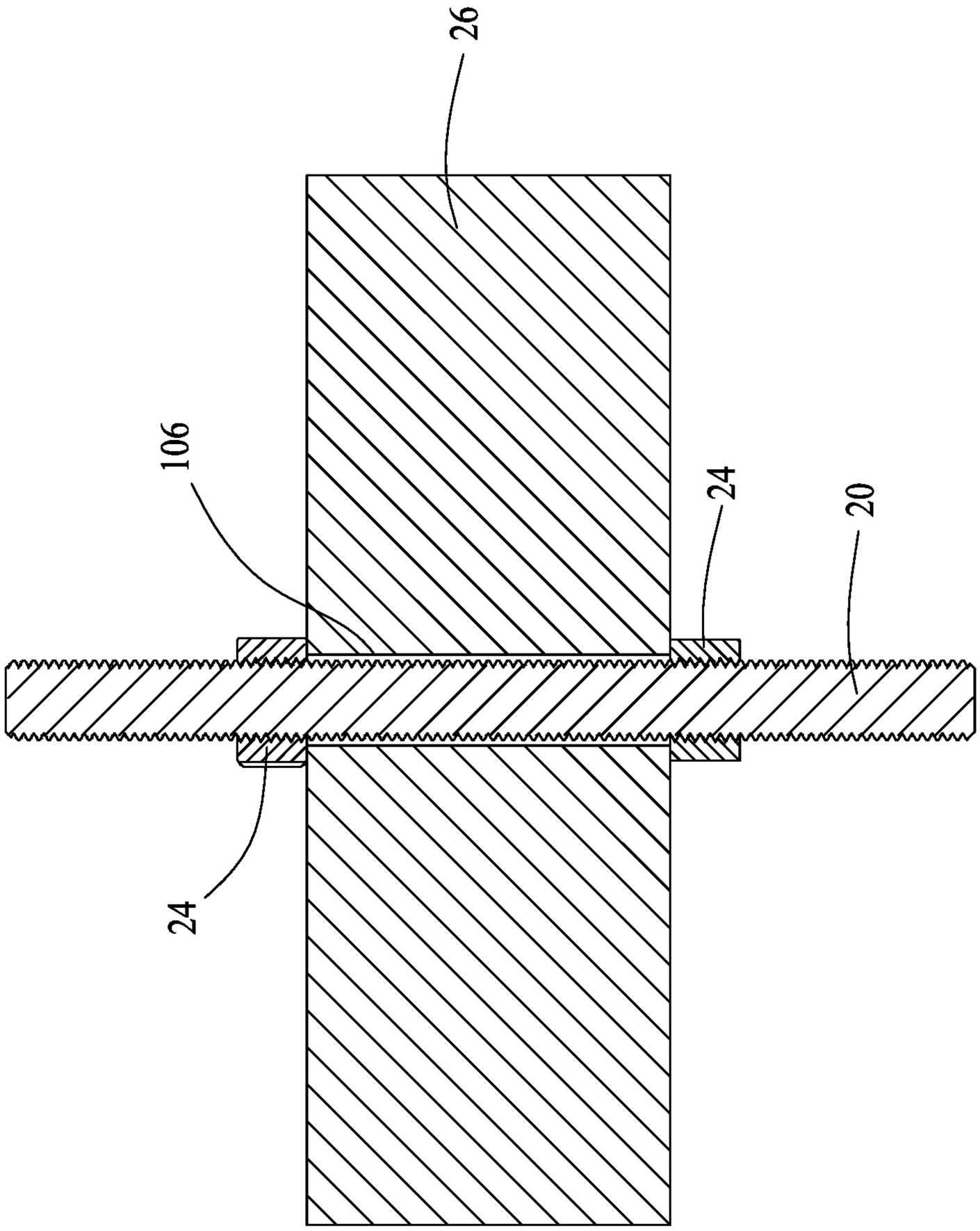


FIG. 64

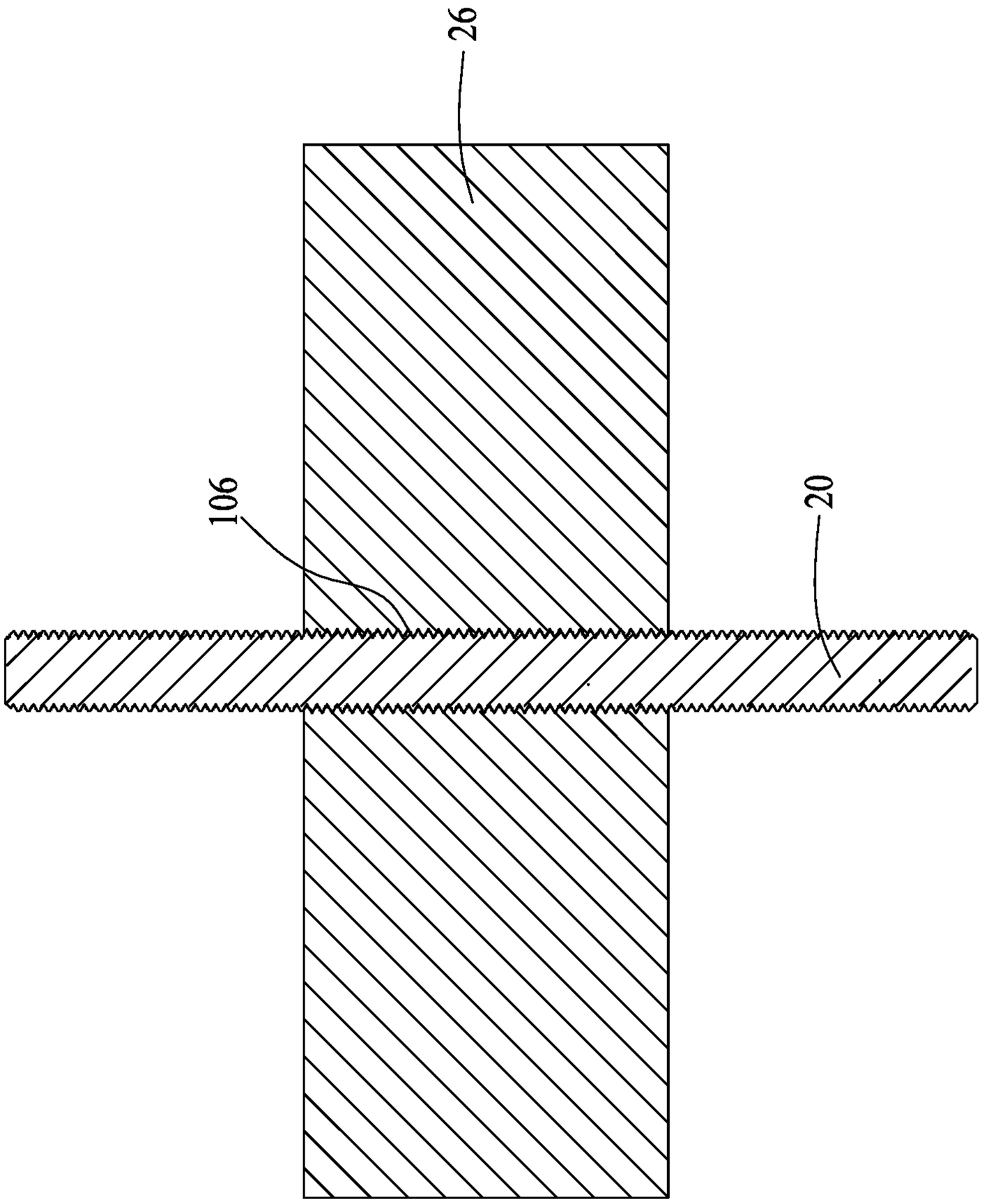


FIG. 65

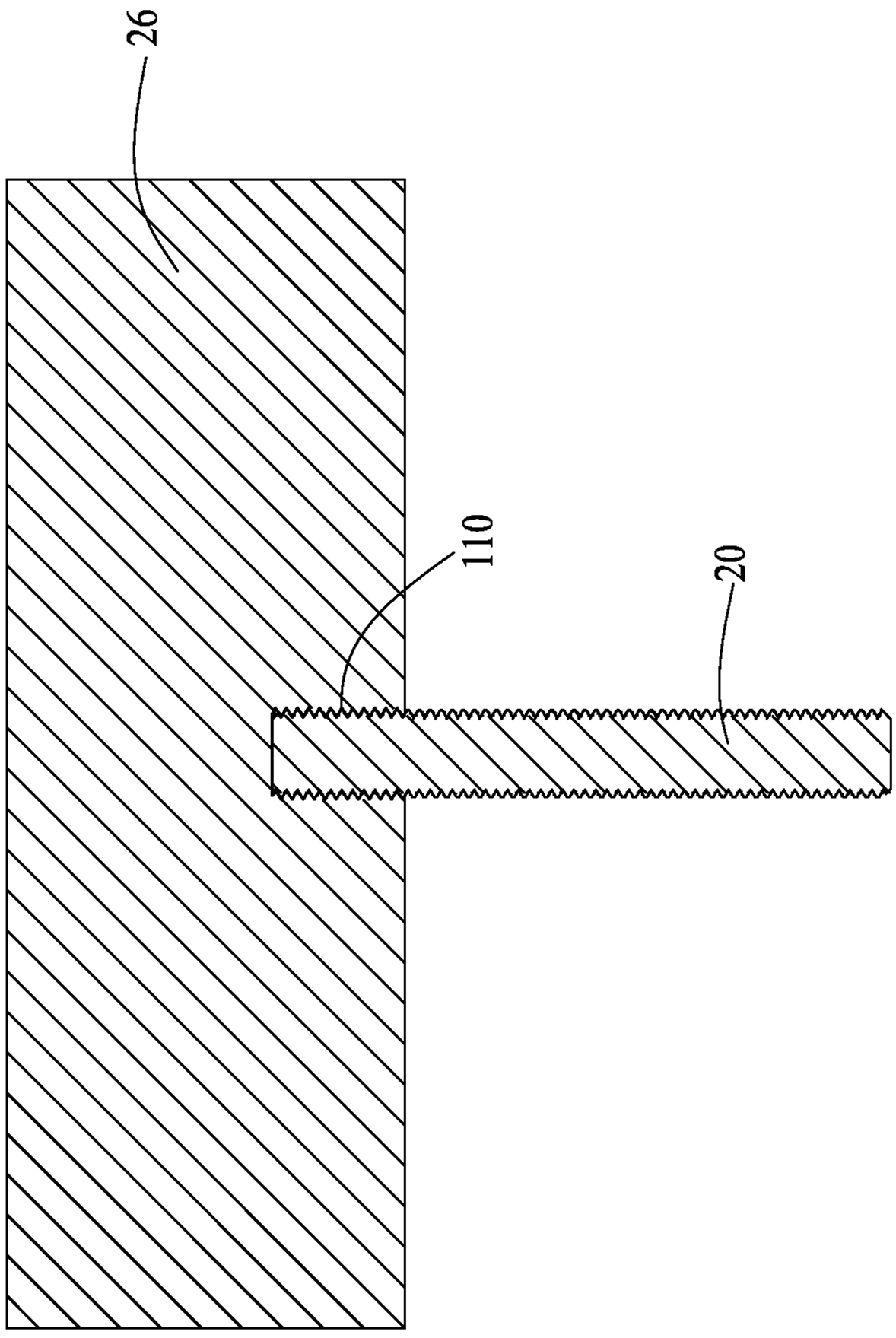


FIG. 66

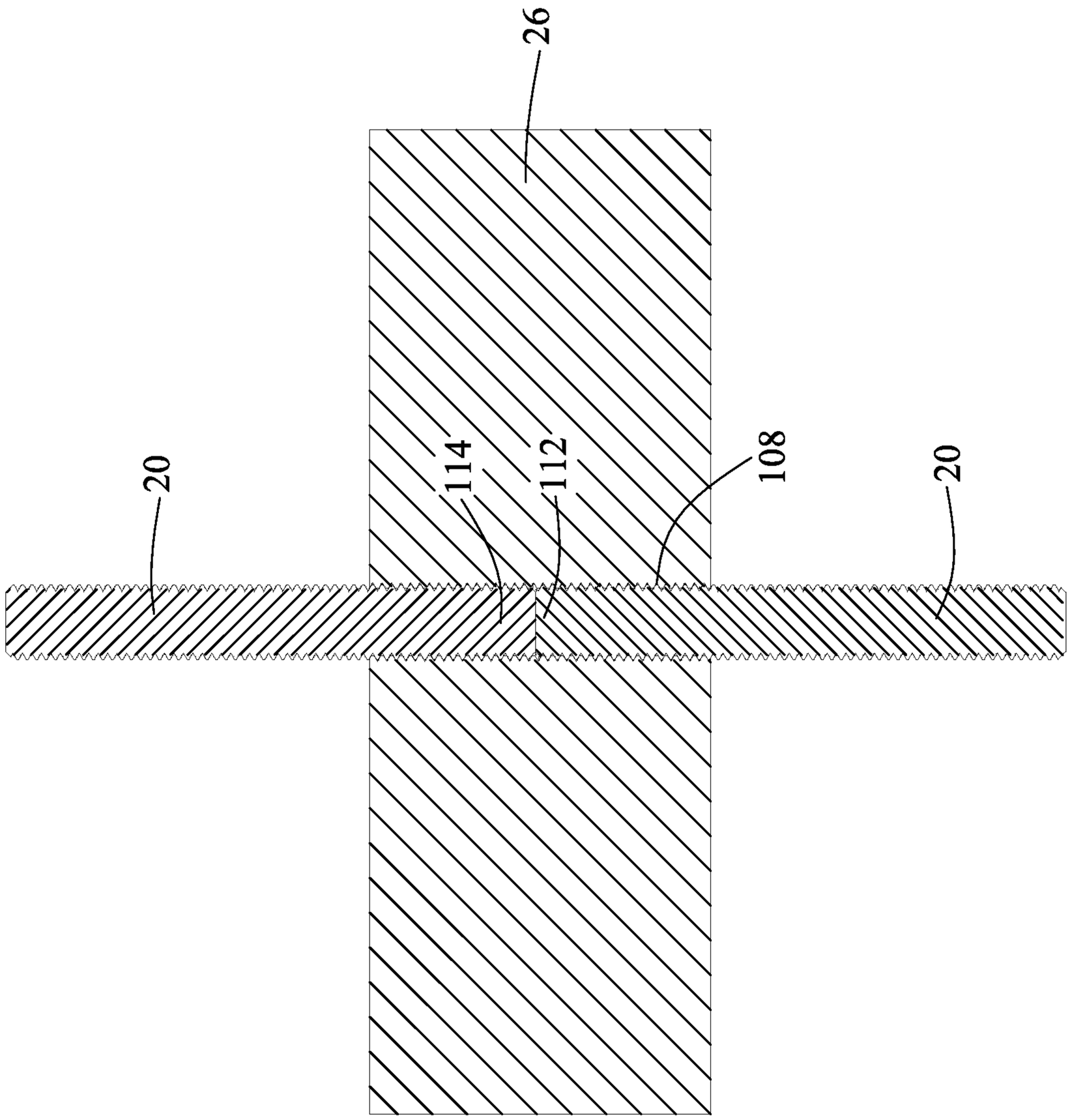


FIG. 67

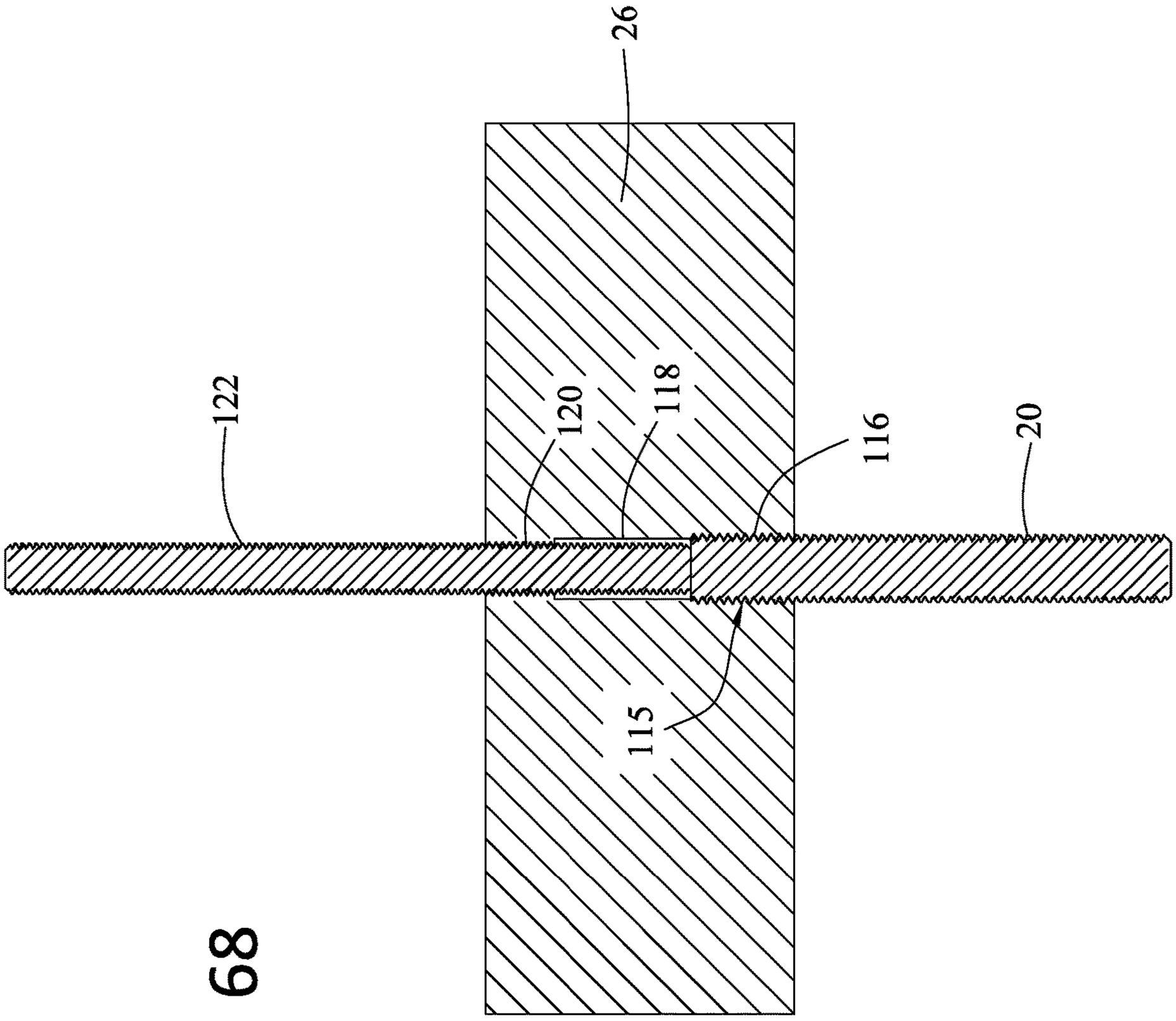


FIG. 68

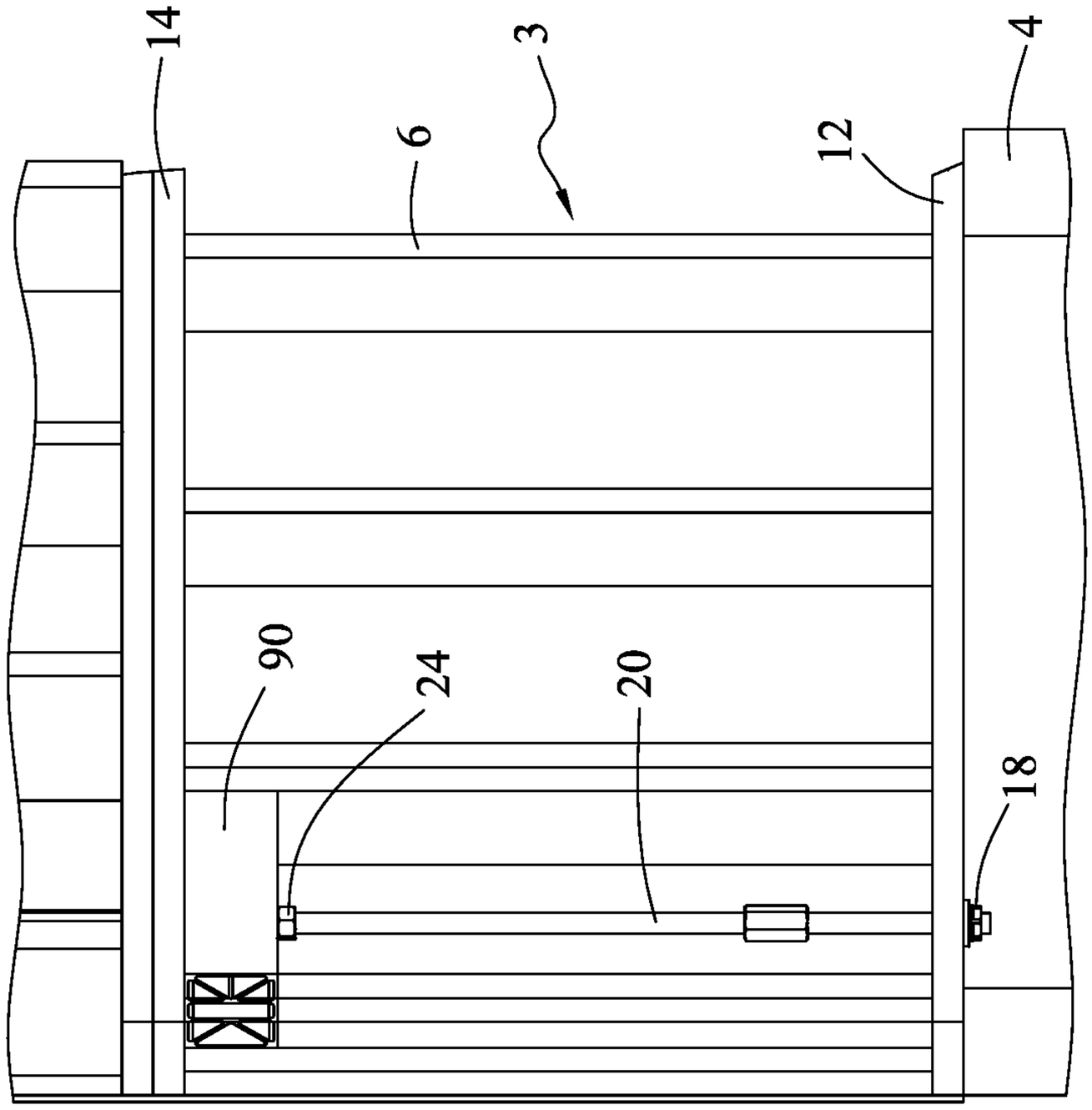


FIG. 69

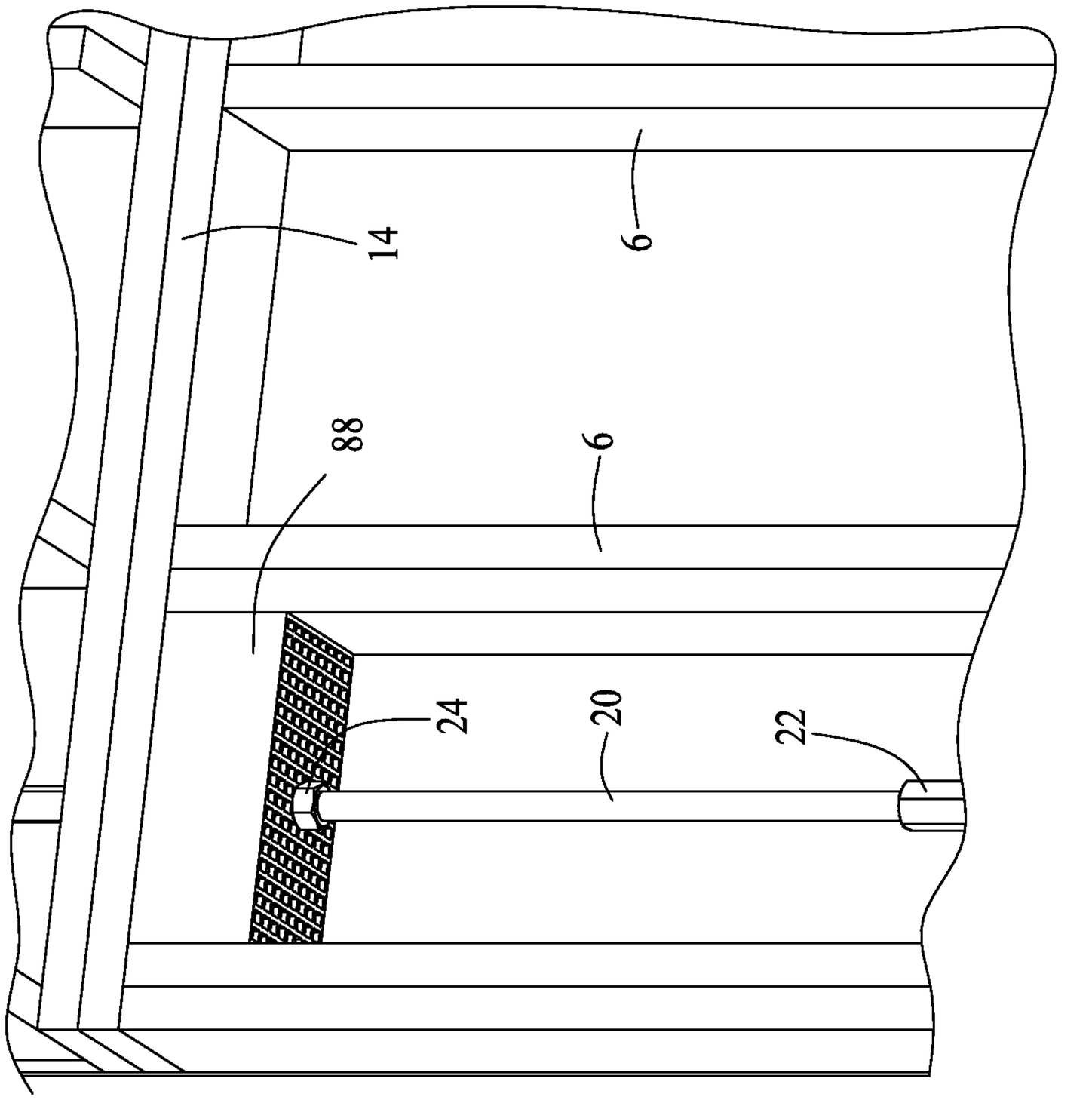


FIG. 70

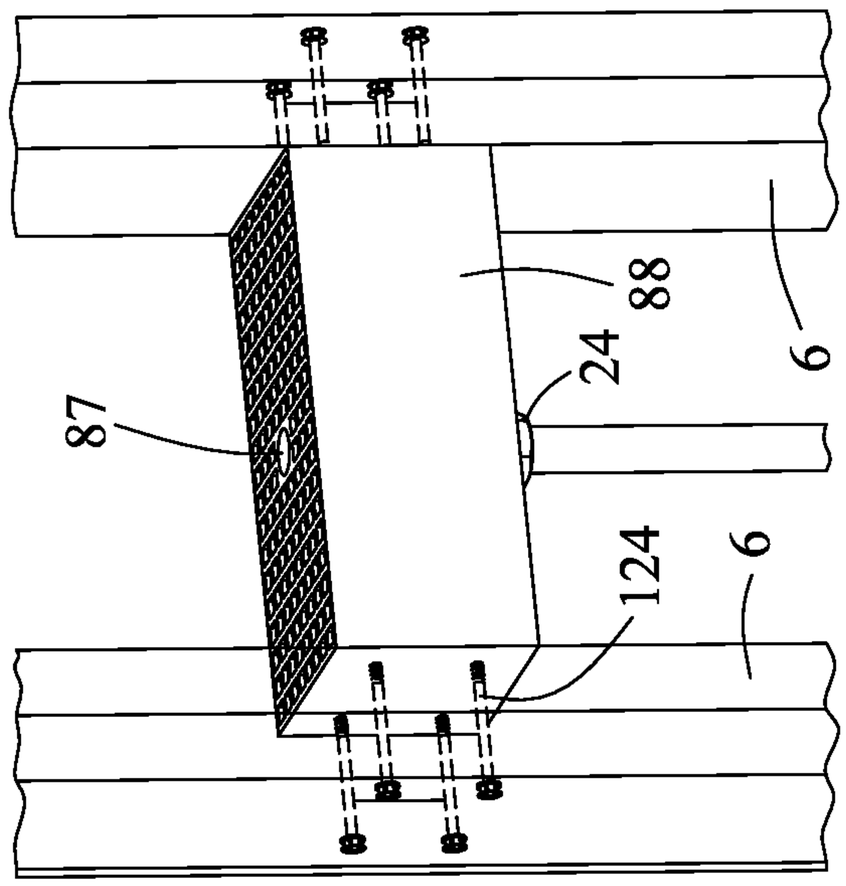


FIG. 72

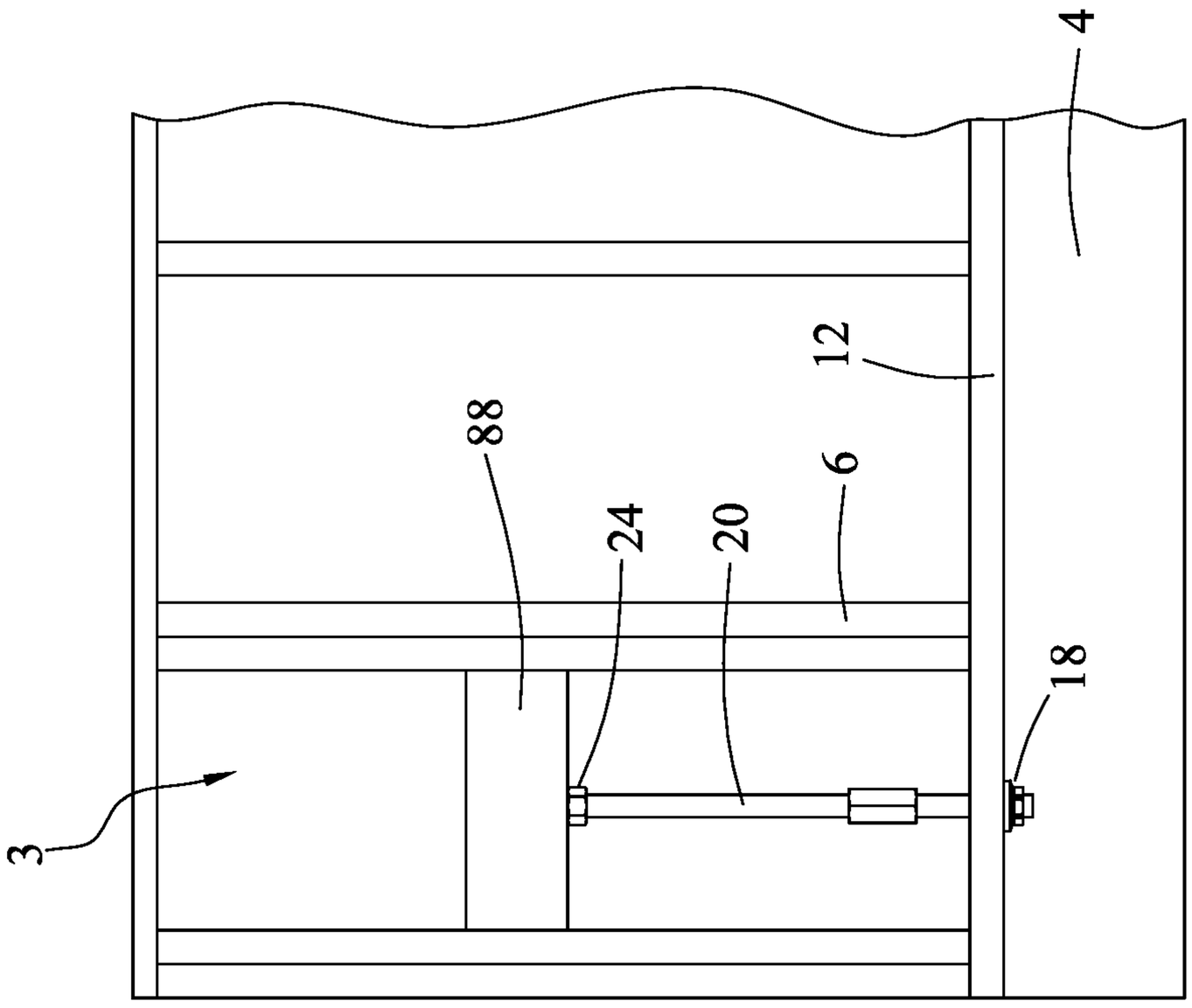


FIG. 71

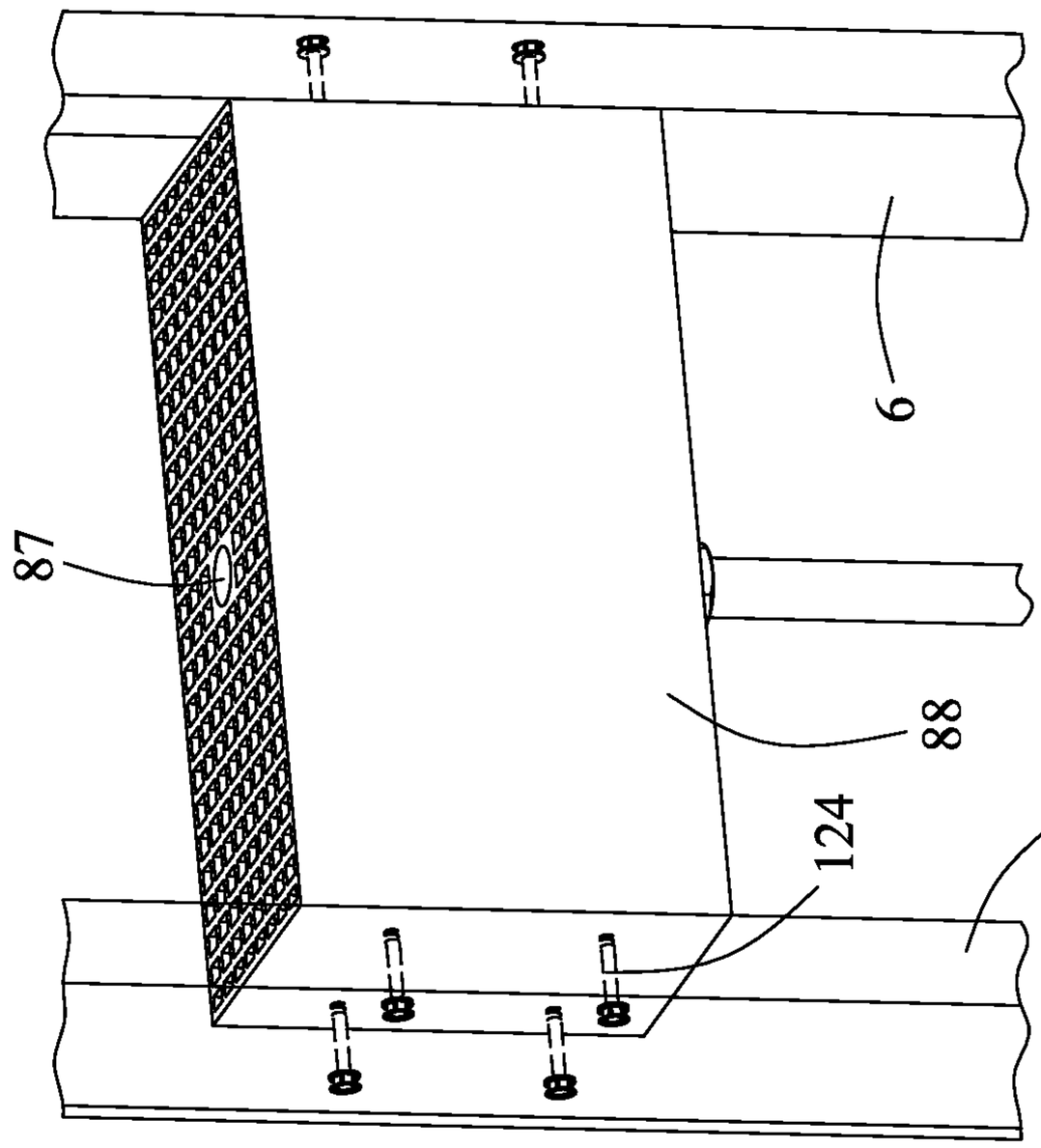


FIG. 74

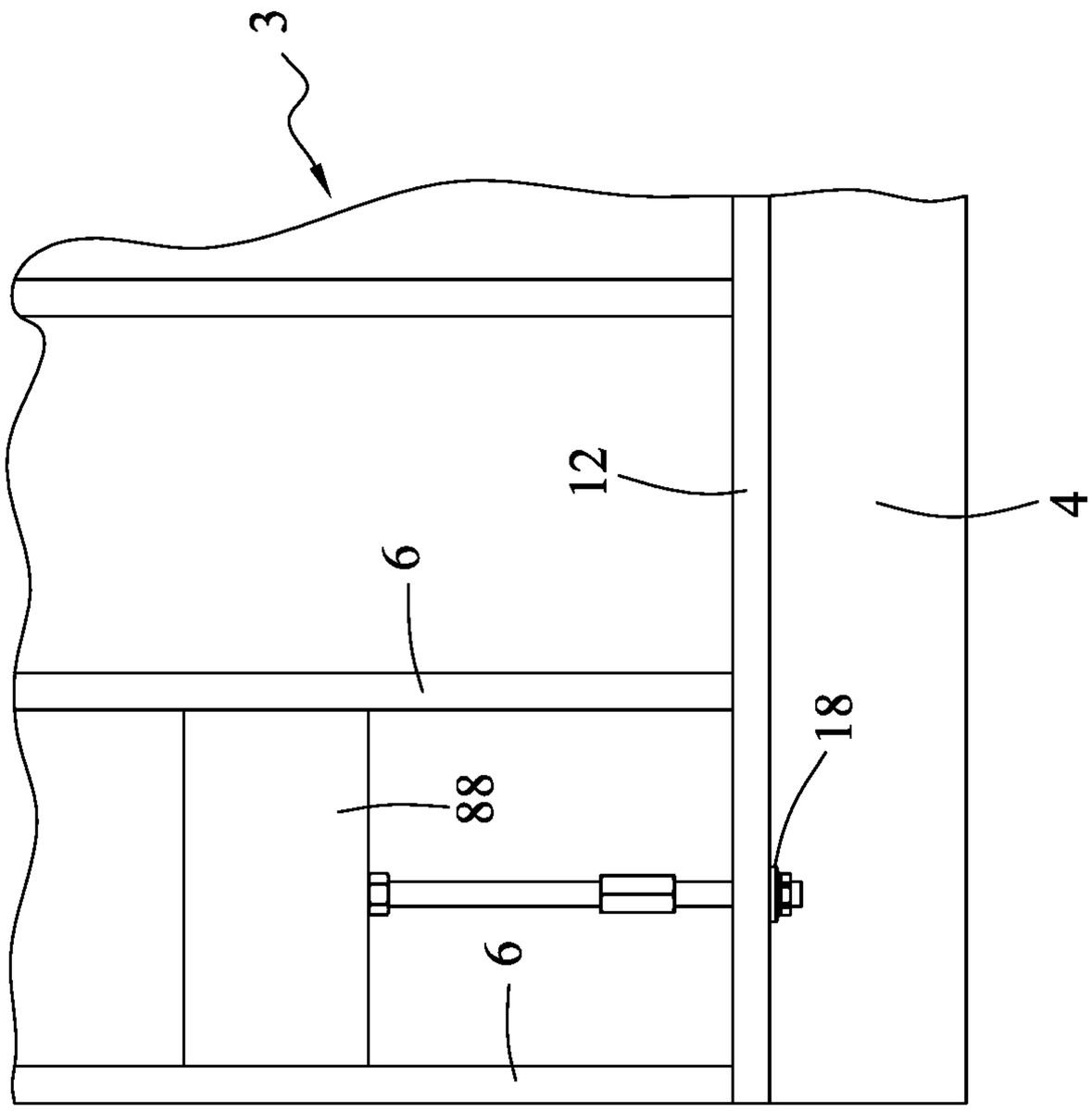


FIG. 73

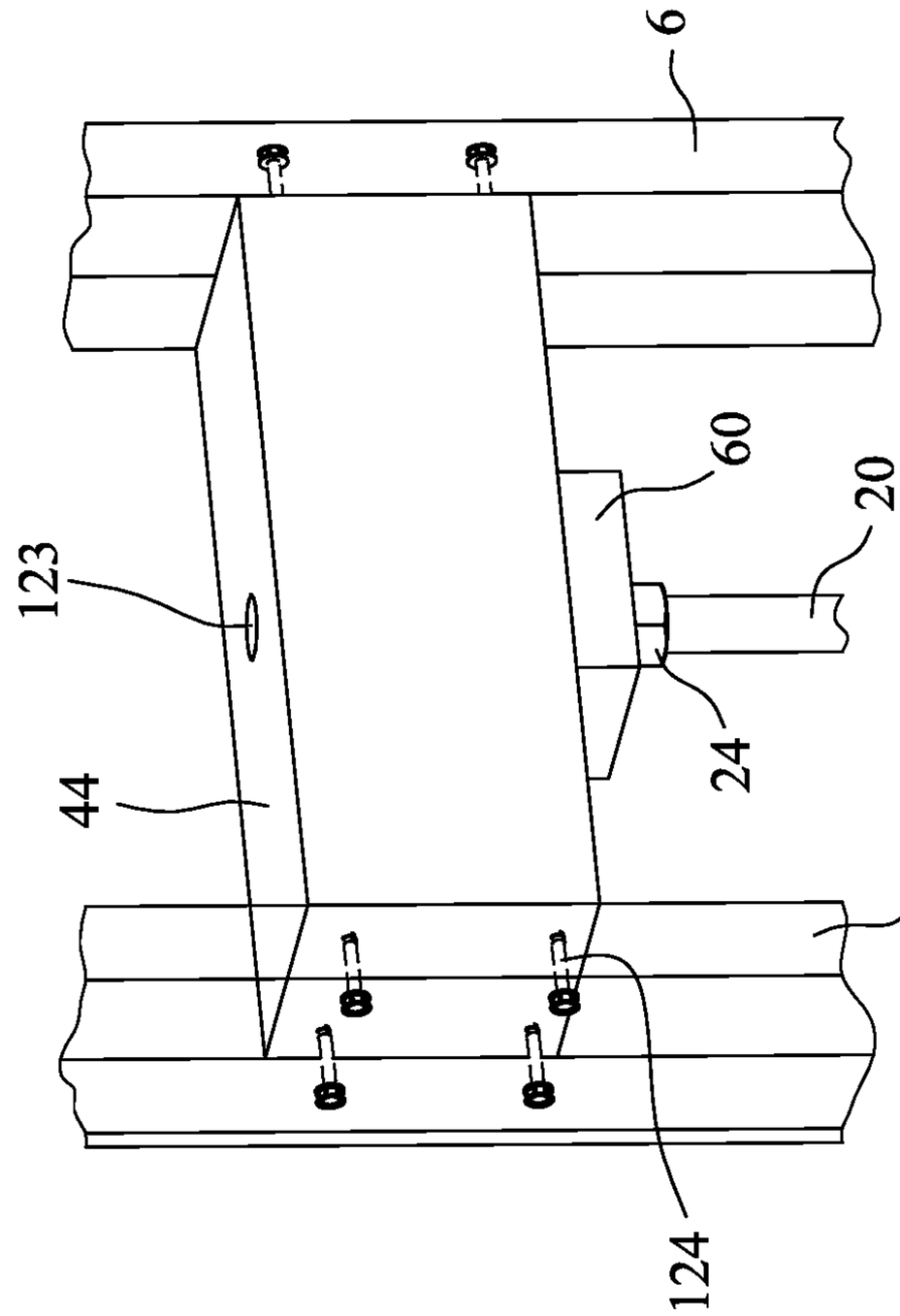


FIG. 76

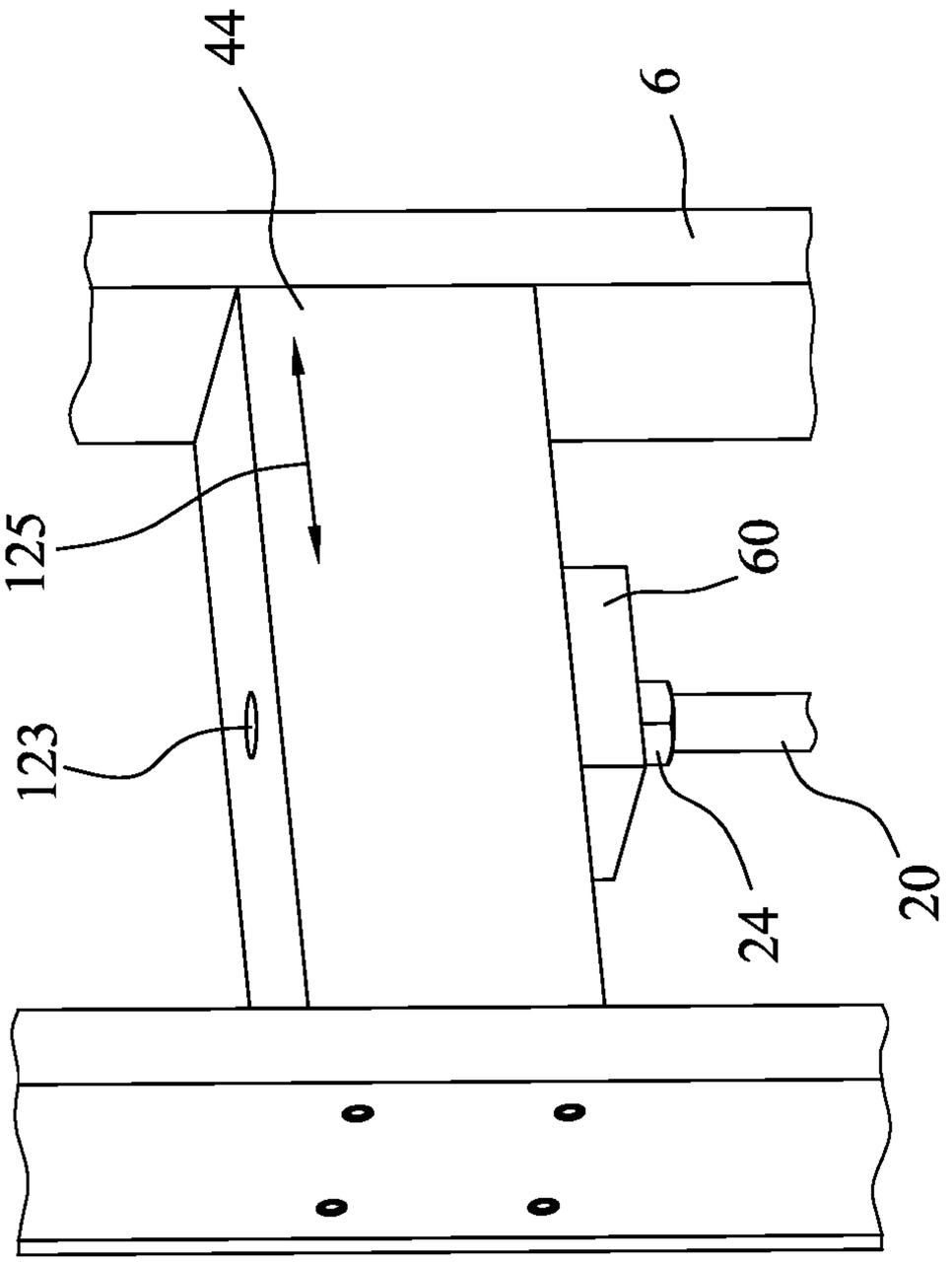


FIG. 75

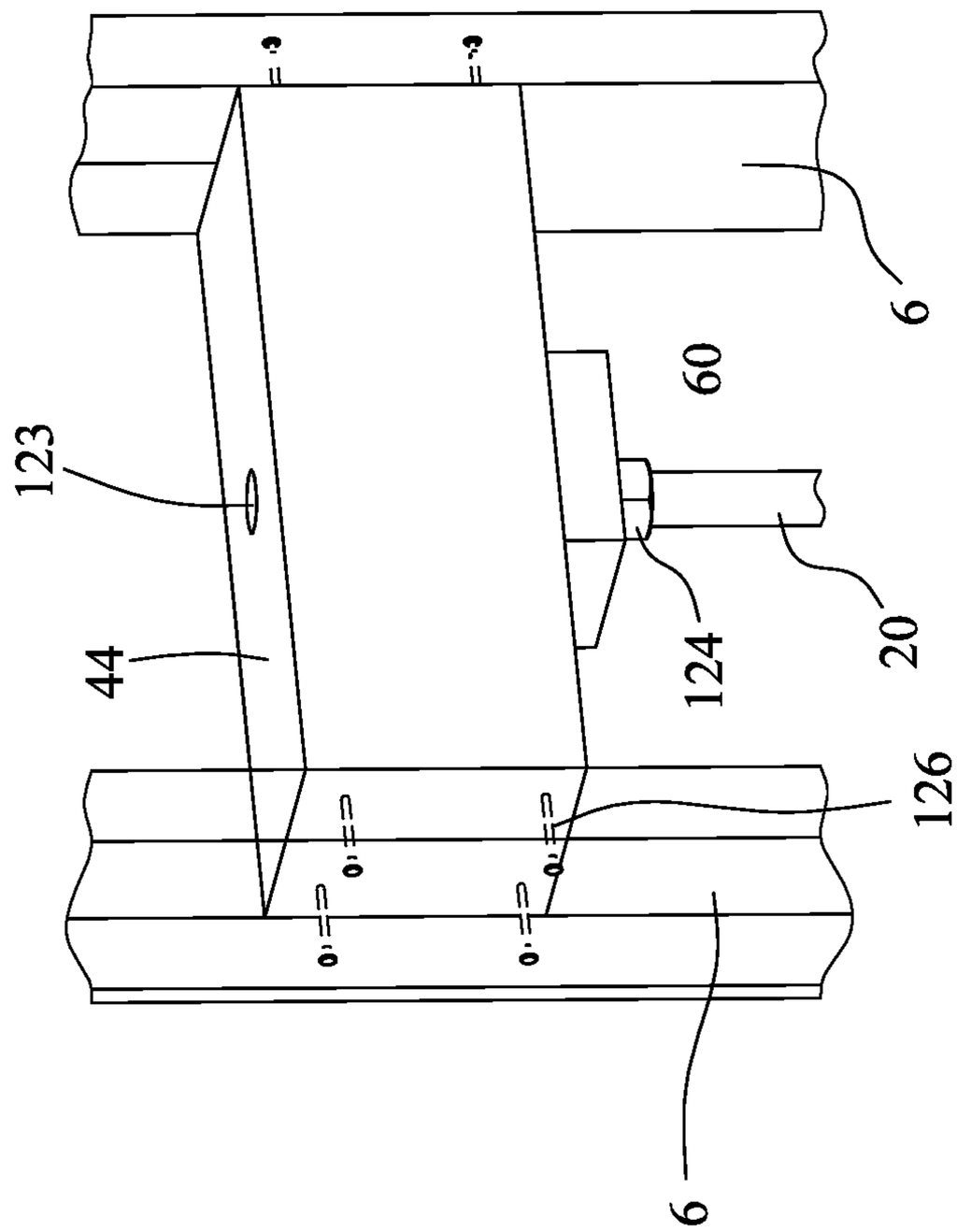


FIG. 78

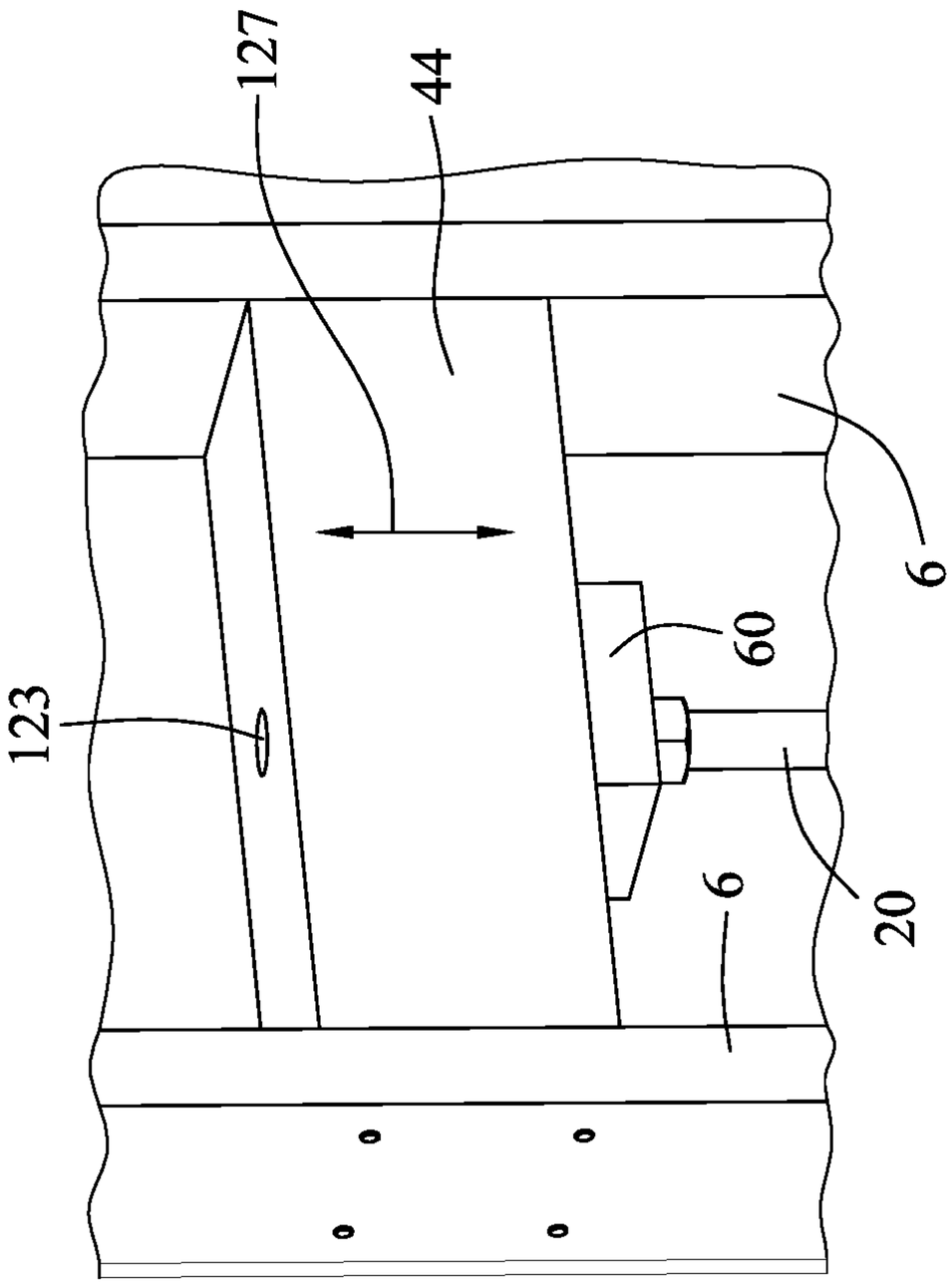


FIG. 77

FIG. 79

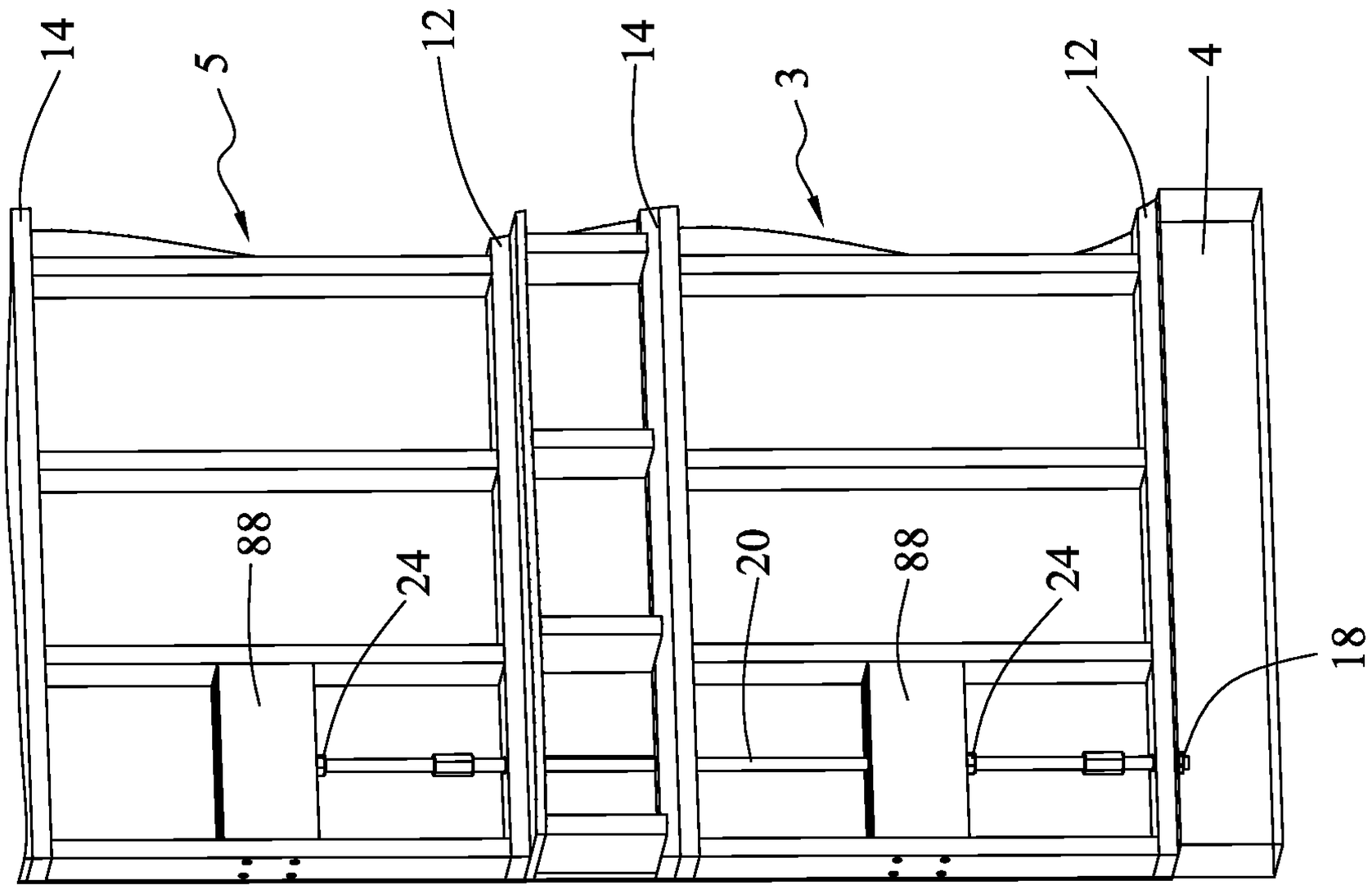
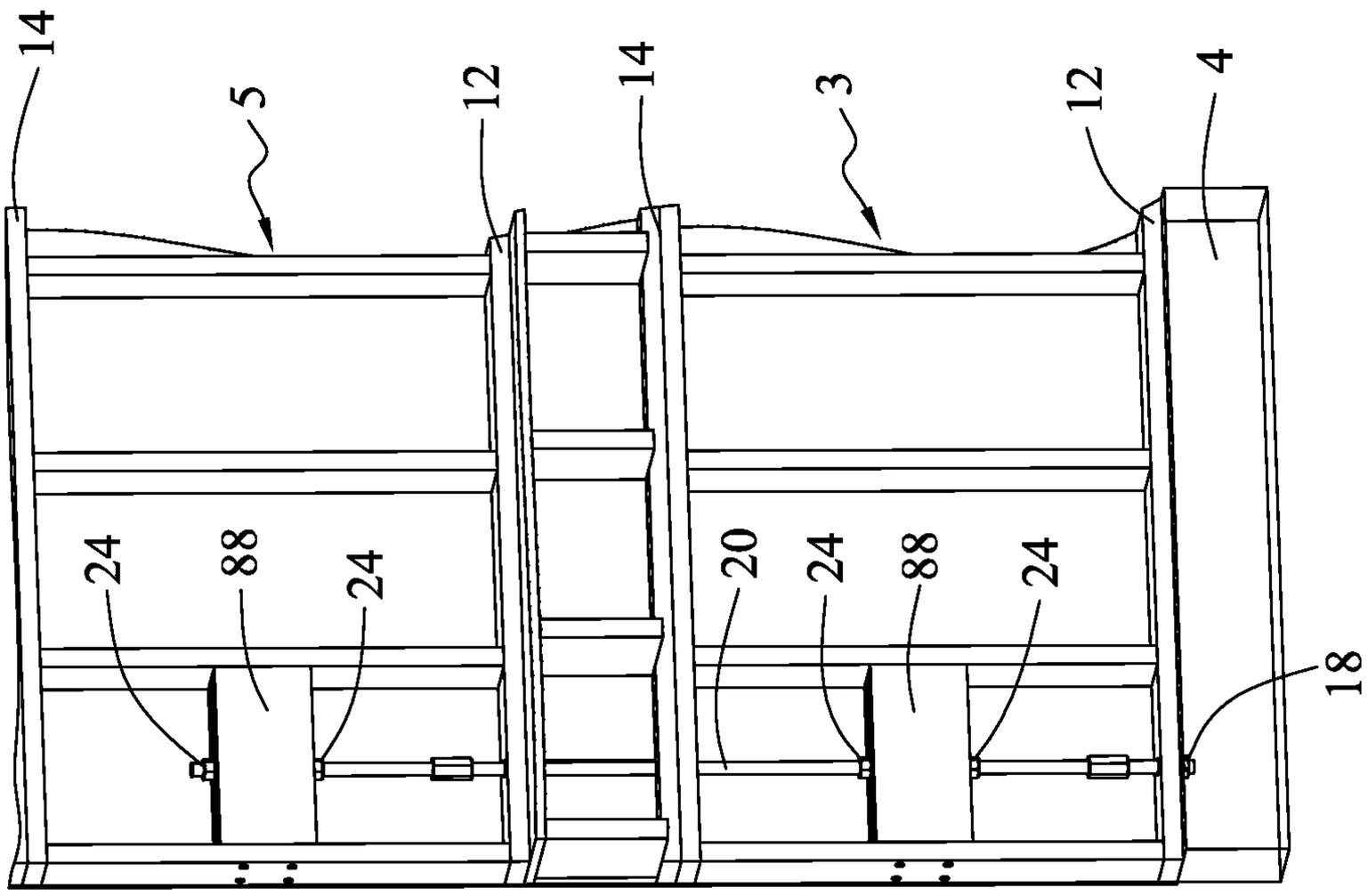
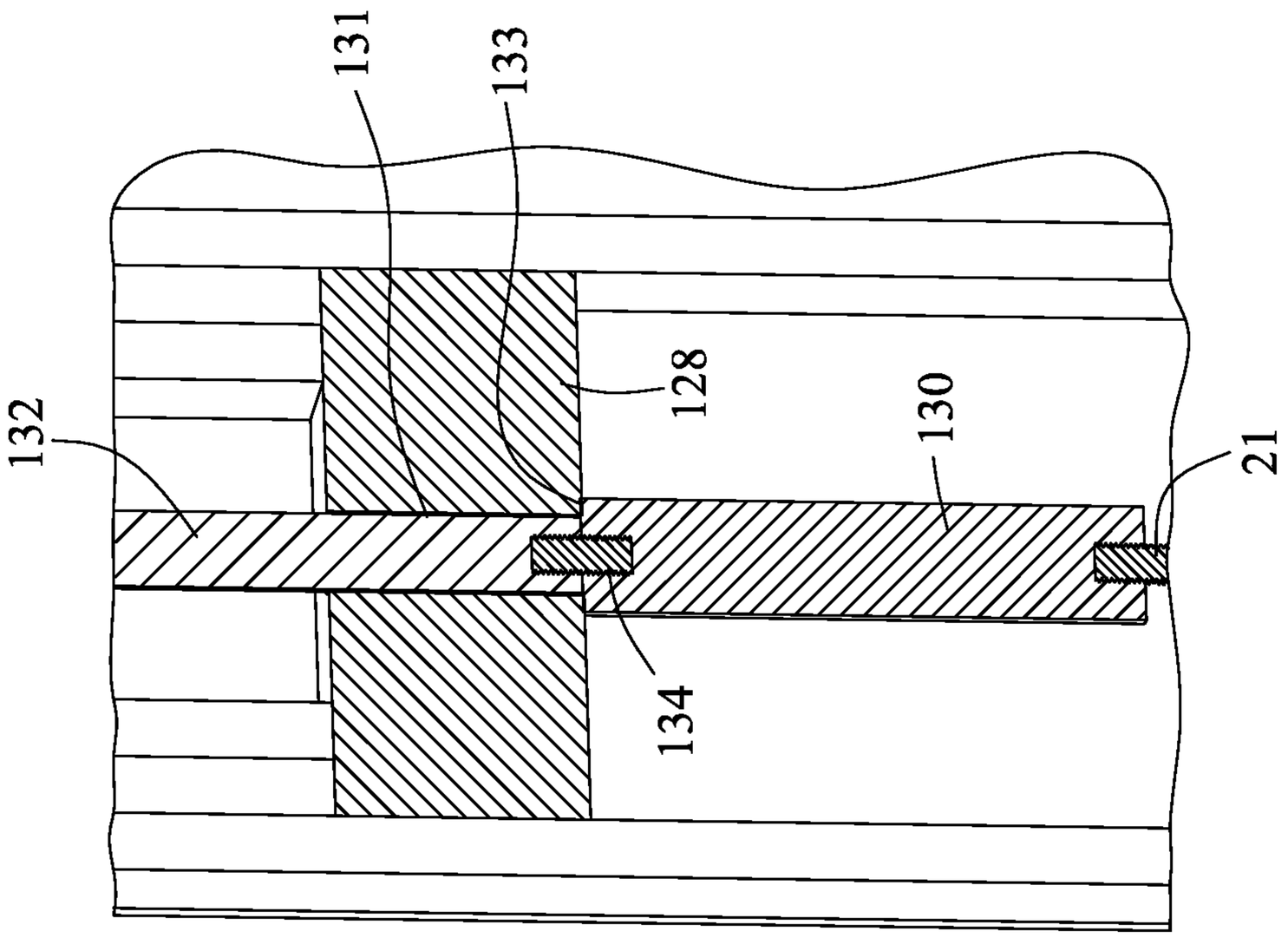


FIG. 8




131
133
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21
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FIG. 82

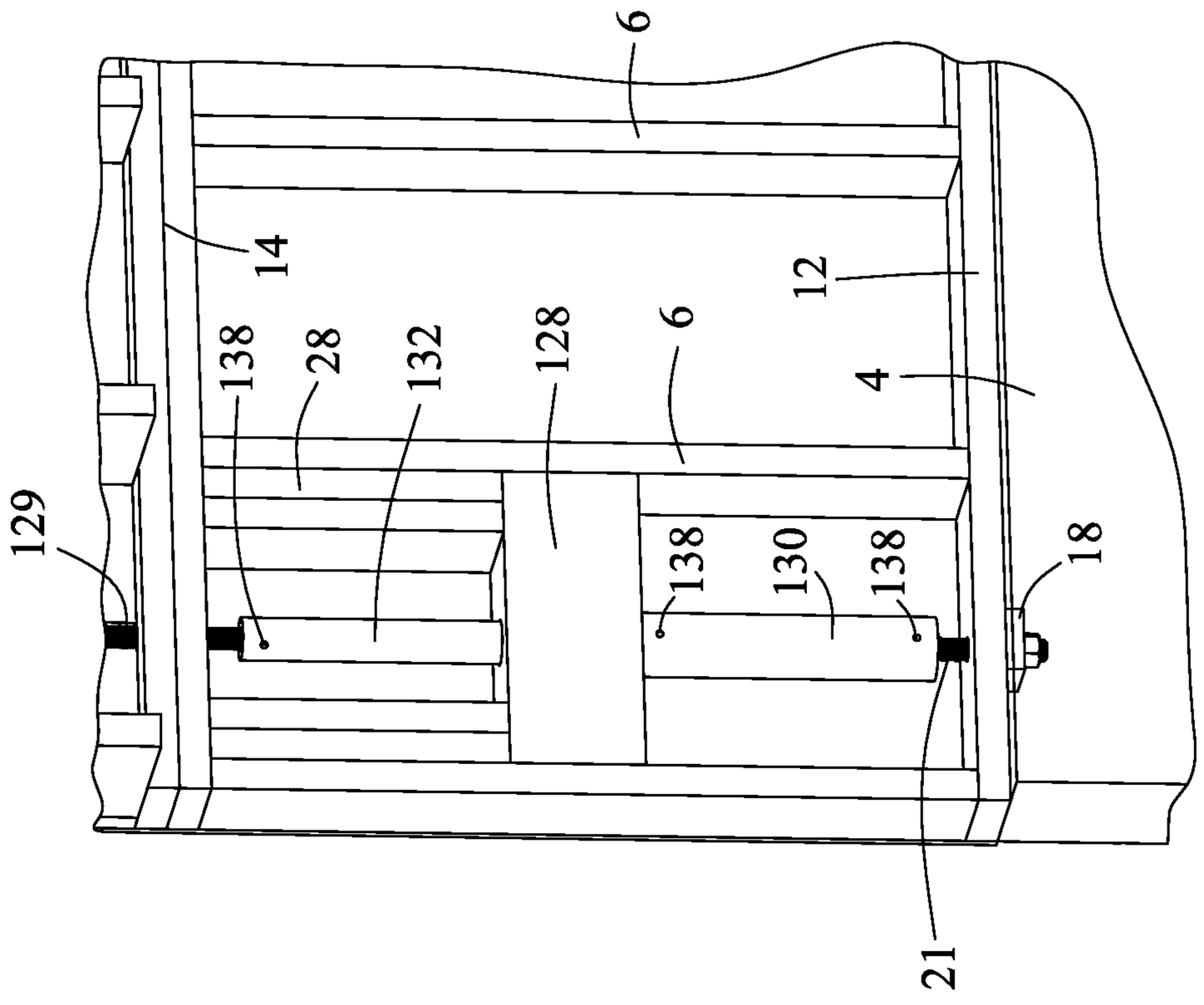
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FIG. 81

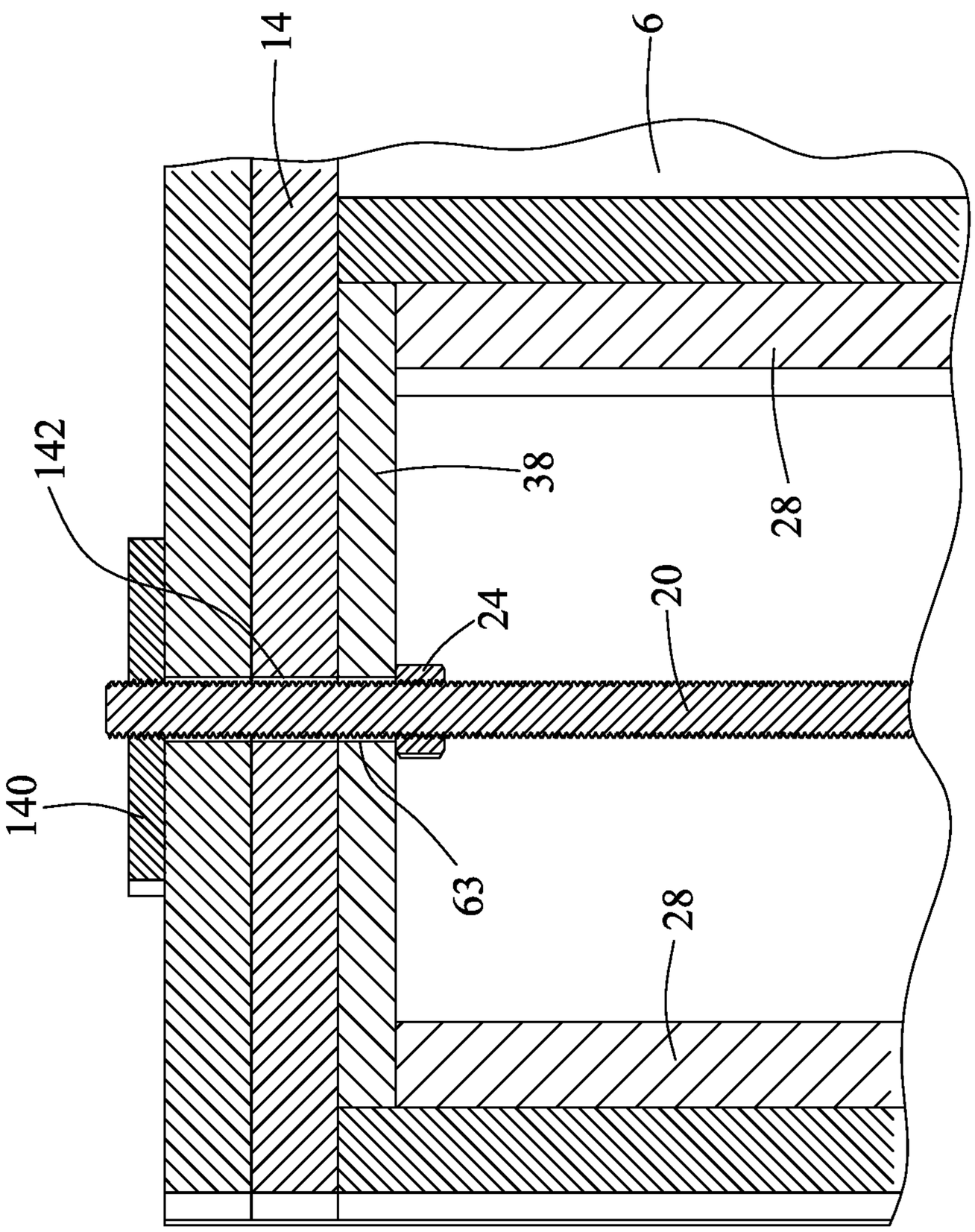


FIG. 83

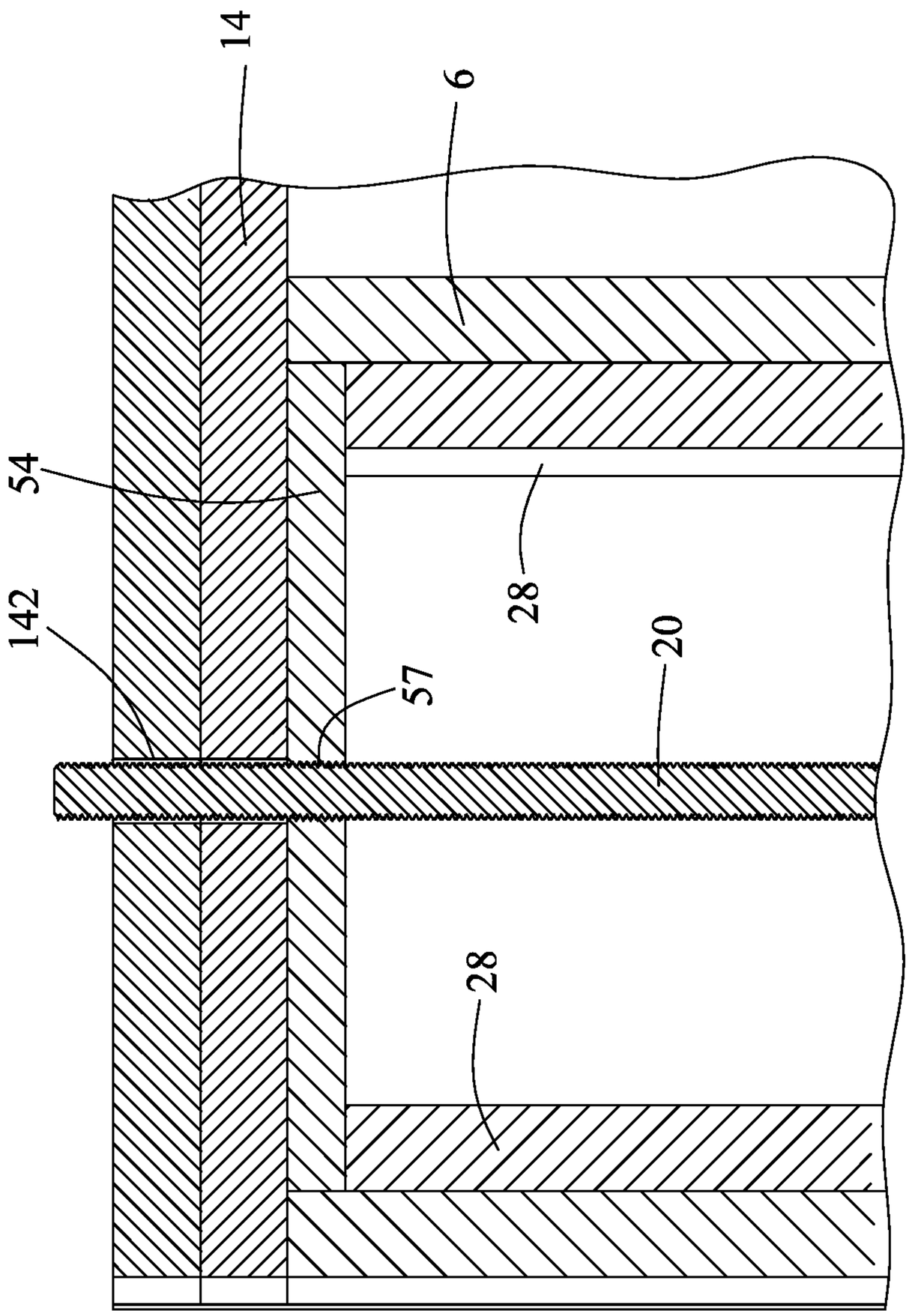


FIG. 84

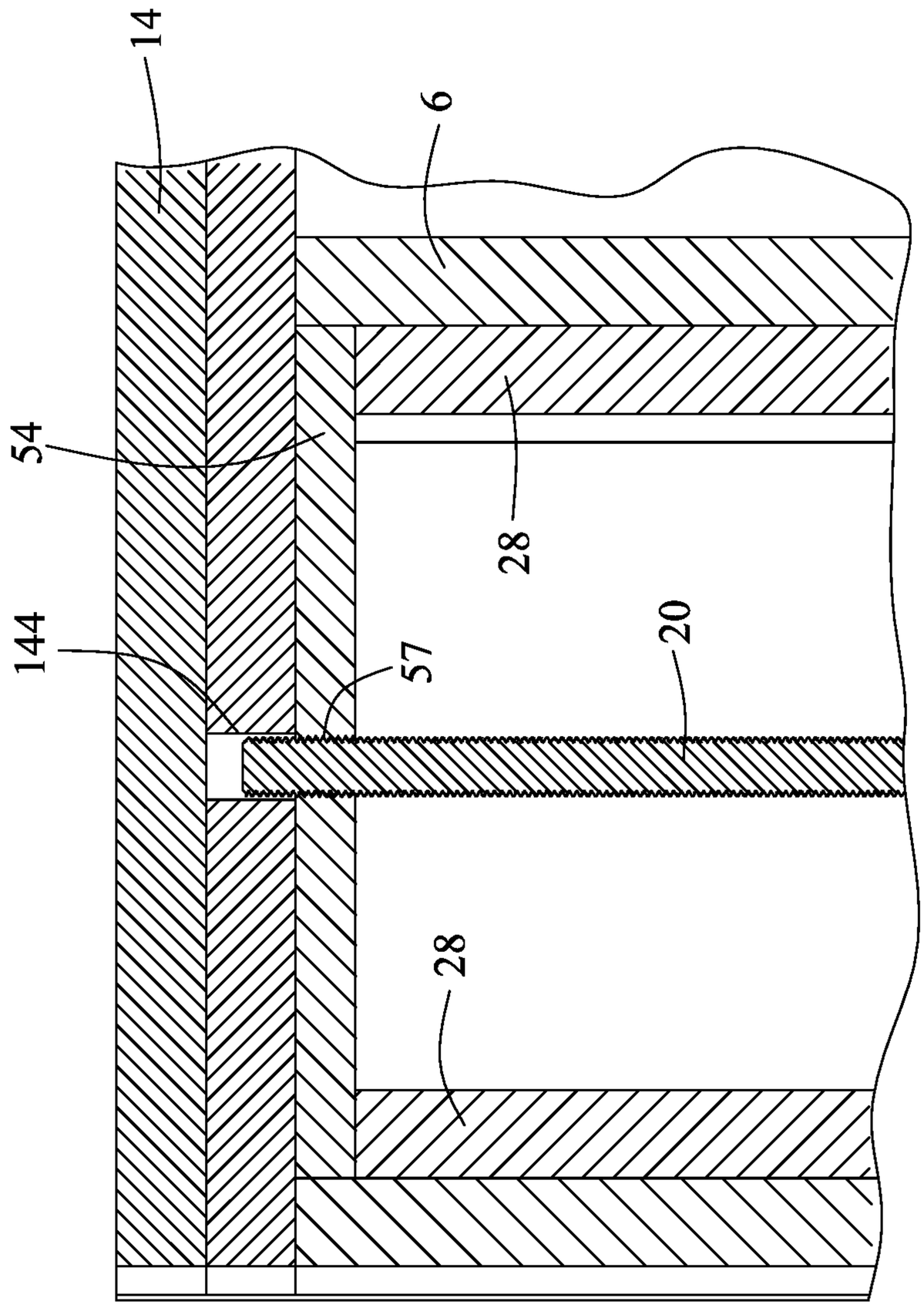


FIG. 85

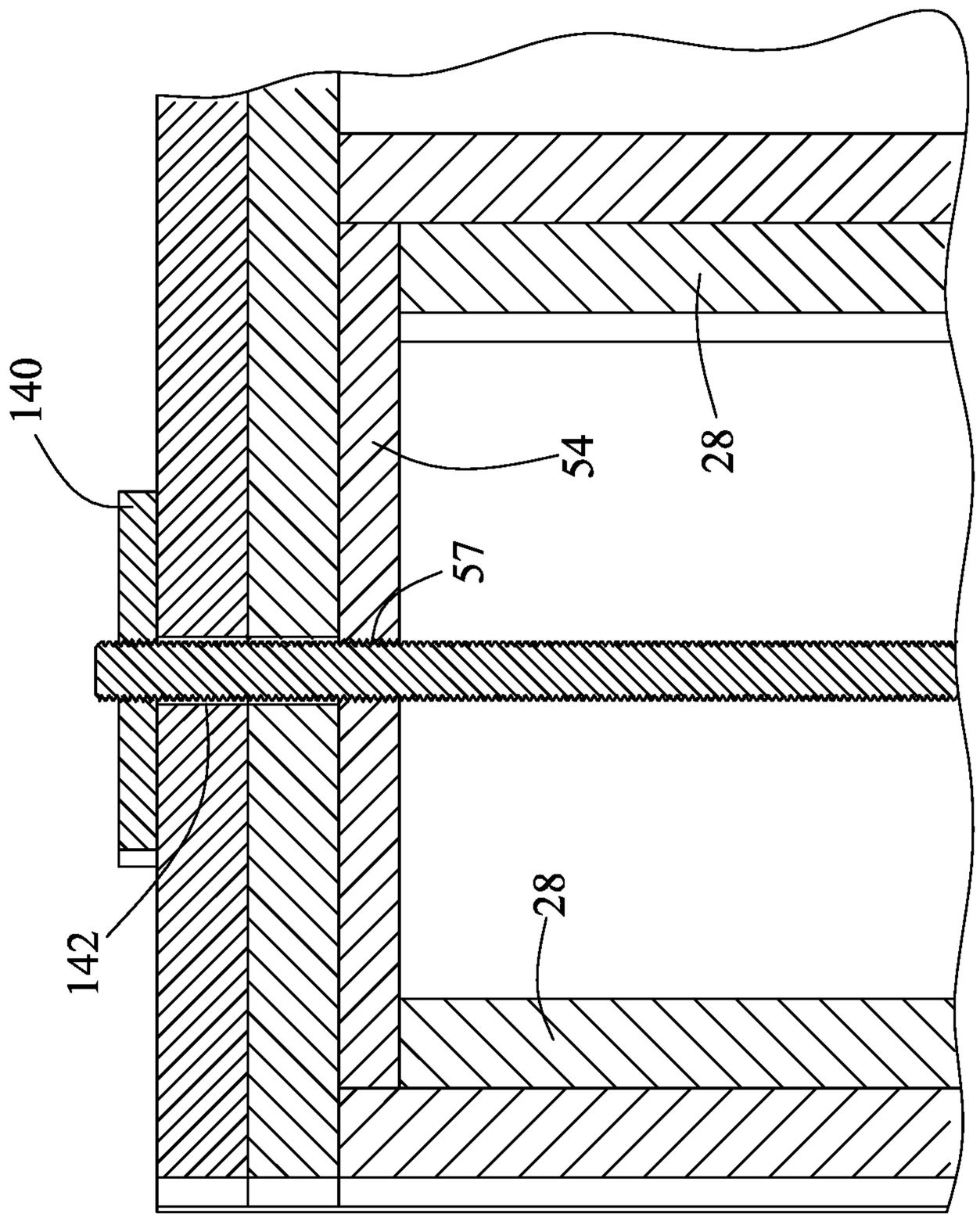


FIG. 86

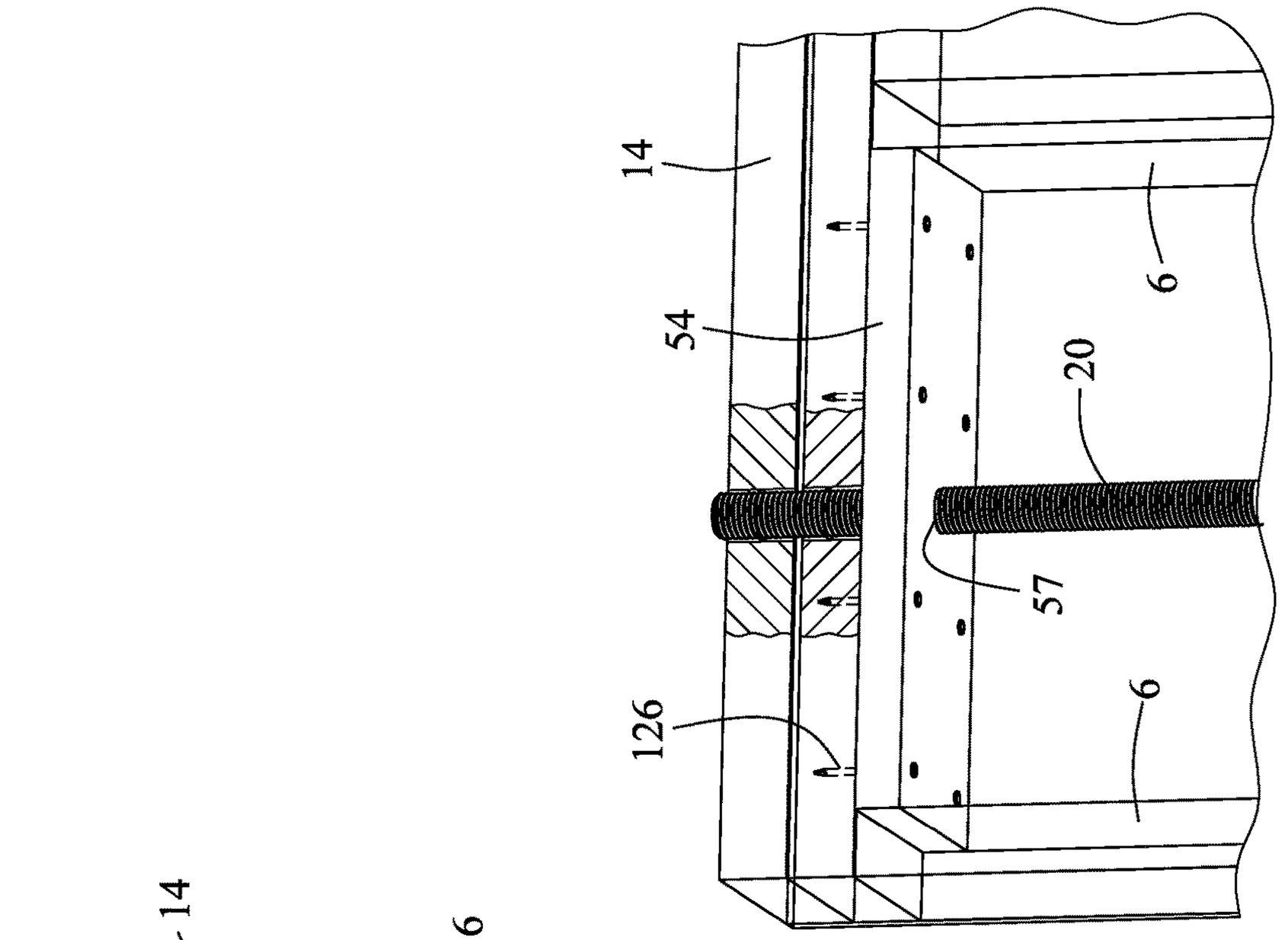


FIG. 88

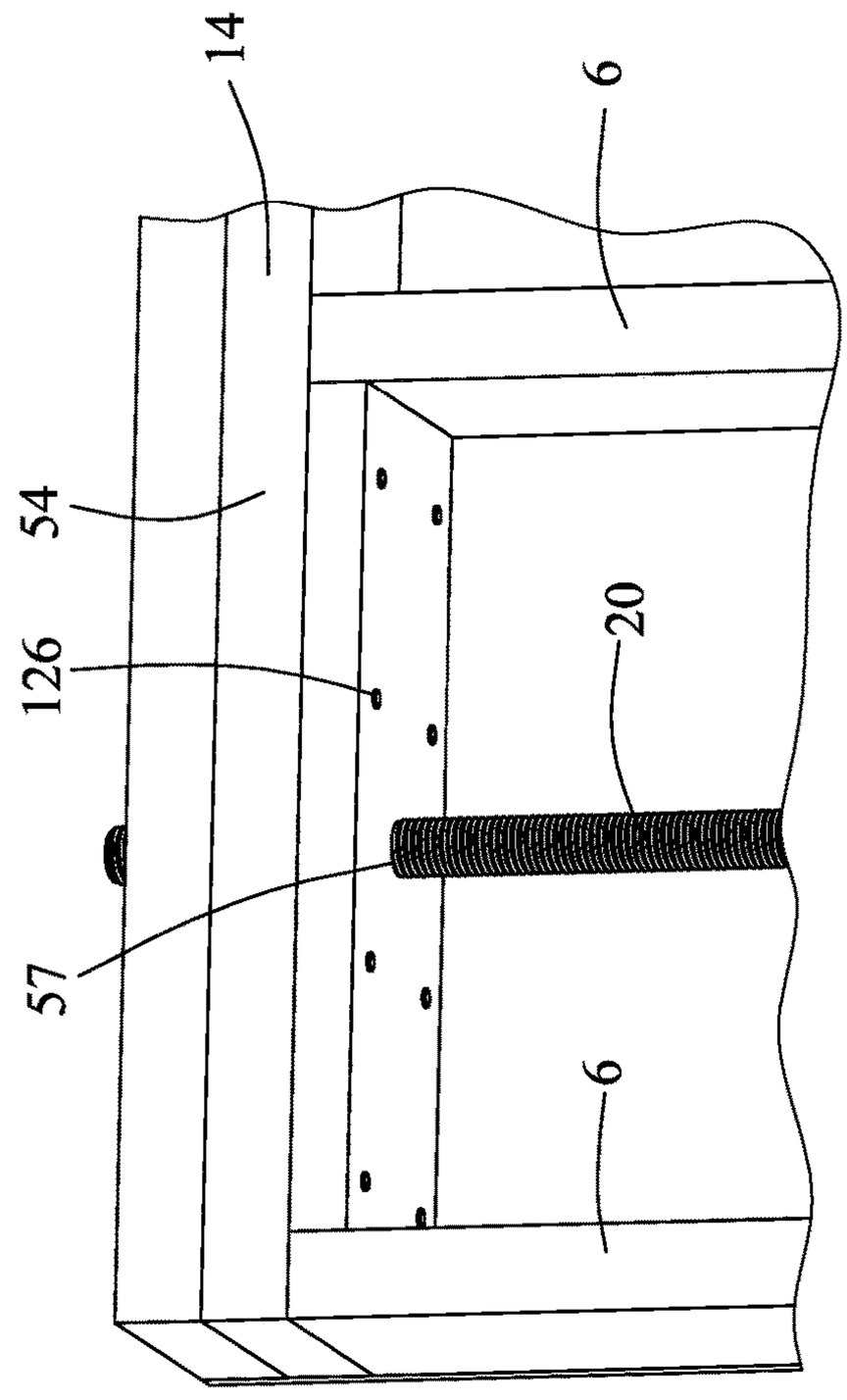


FIG. 87

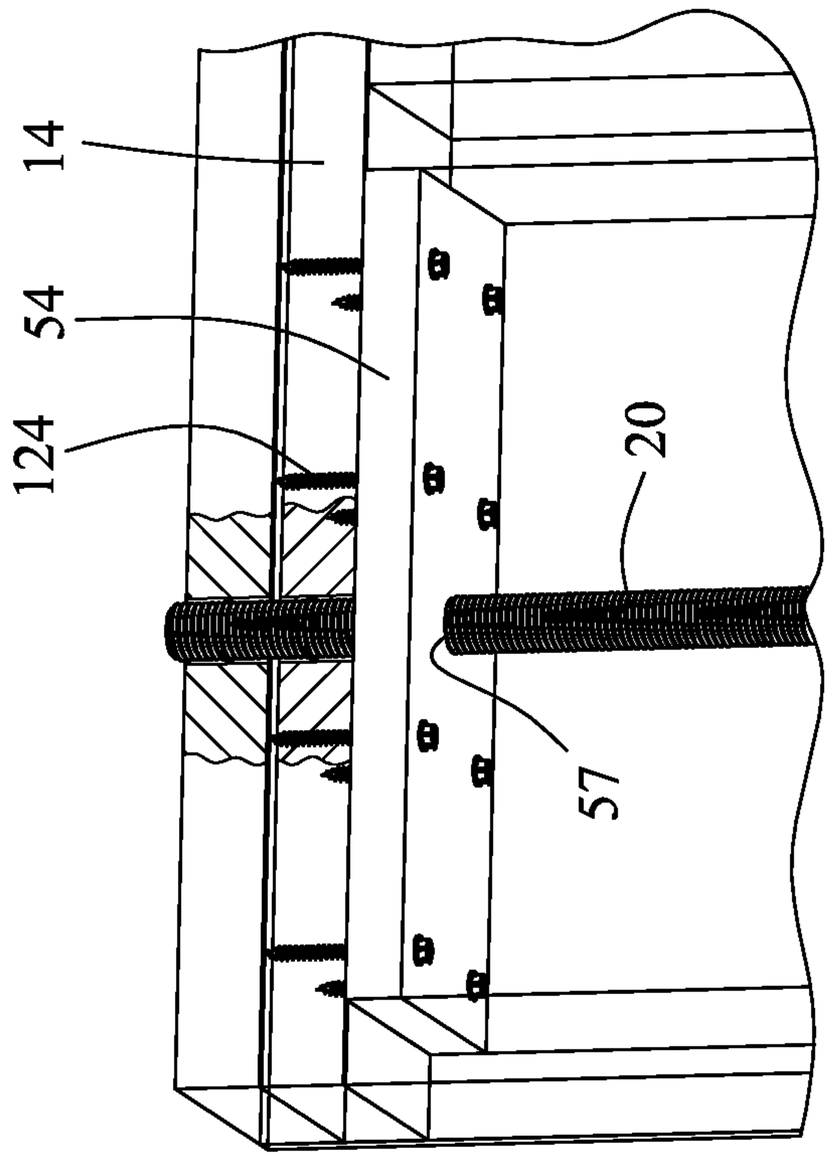


FIG. 90

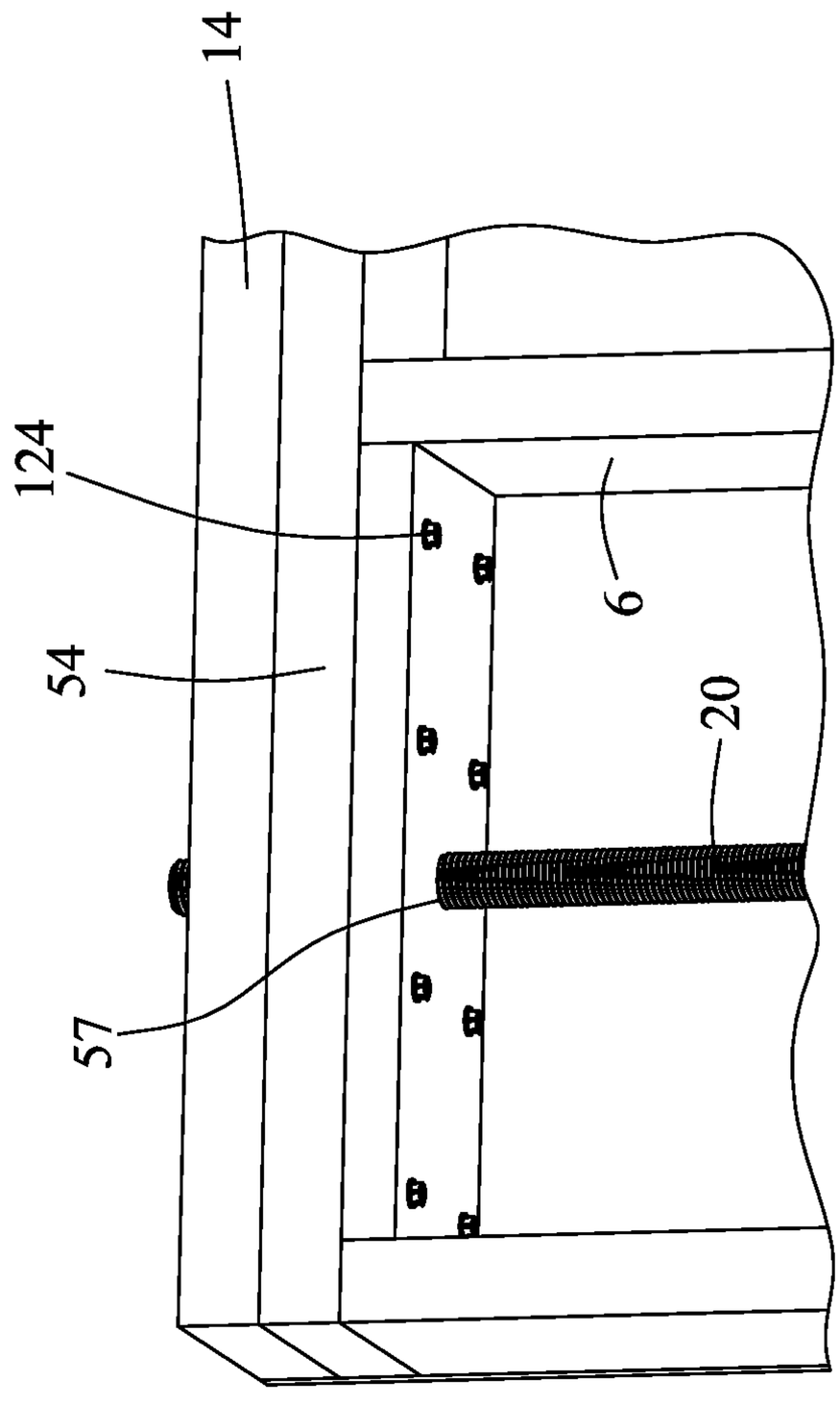


FIG. 89

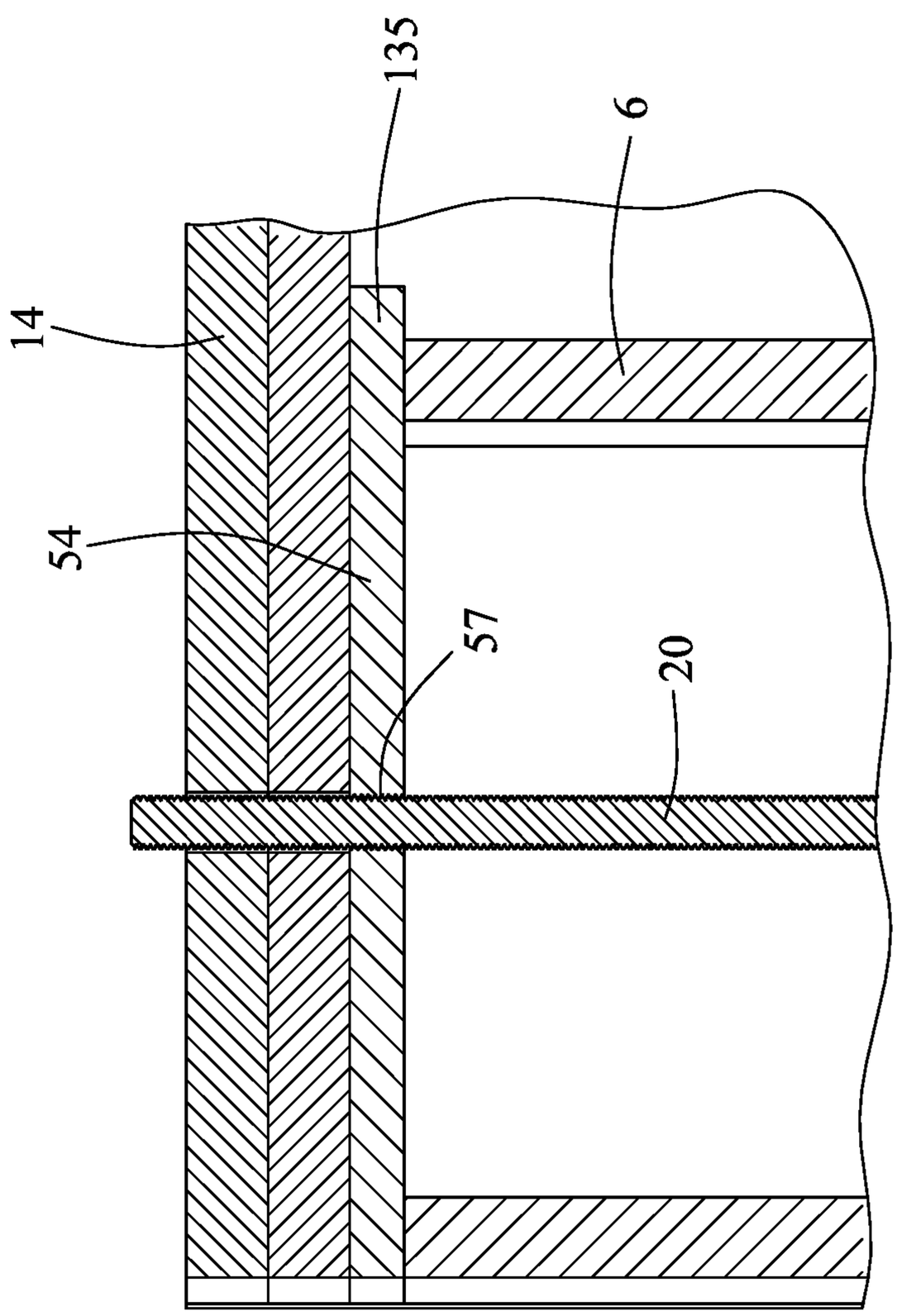


FIG. 91

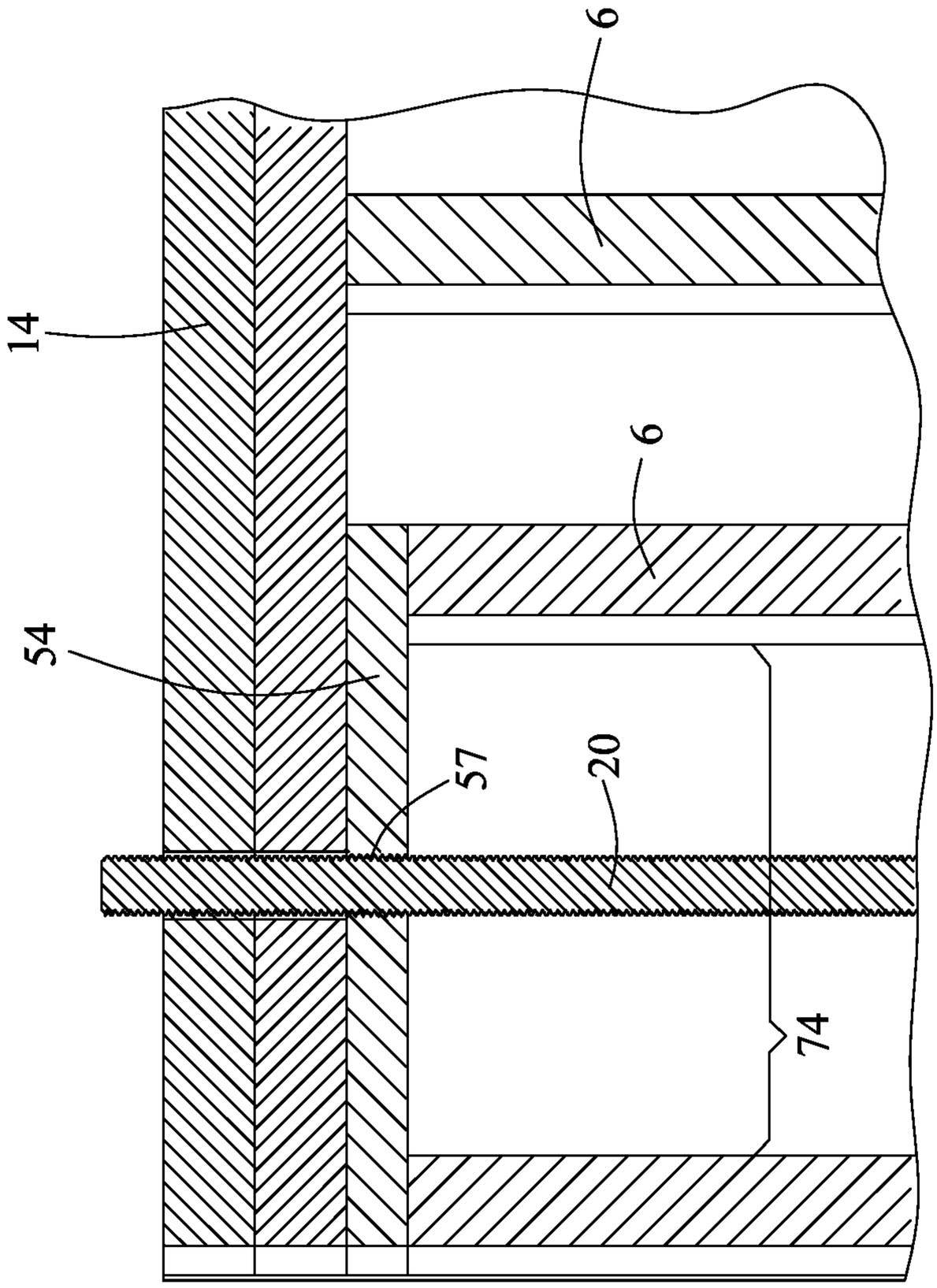


FIG. 92

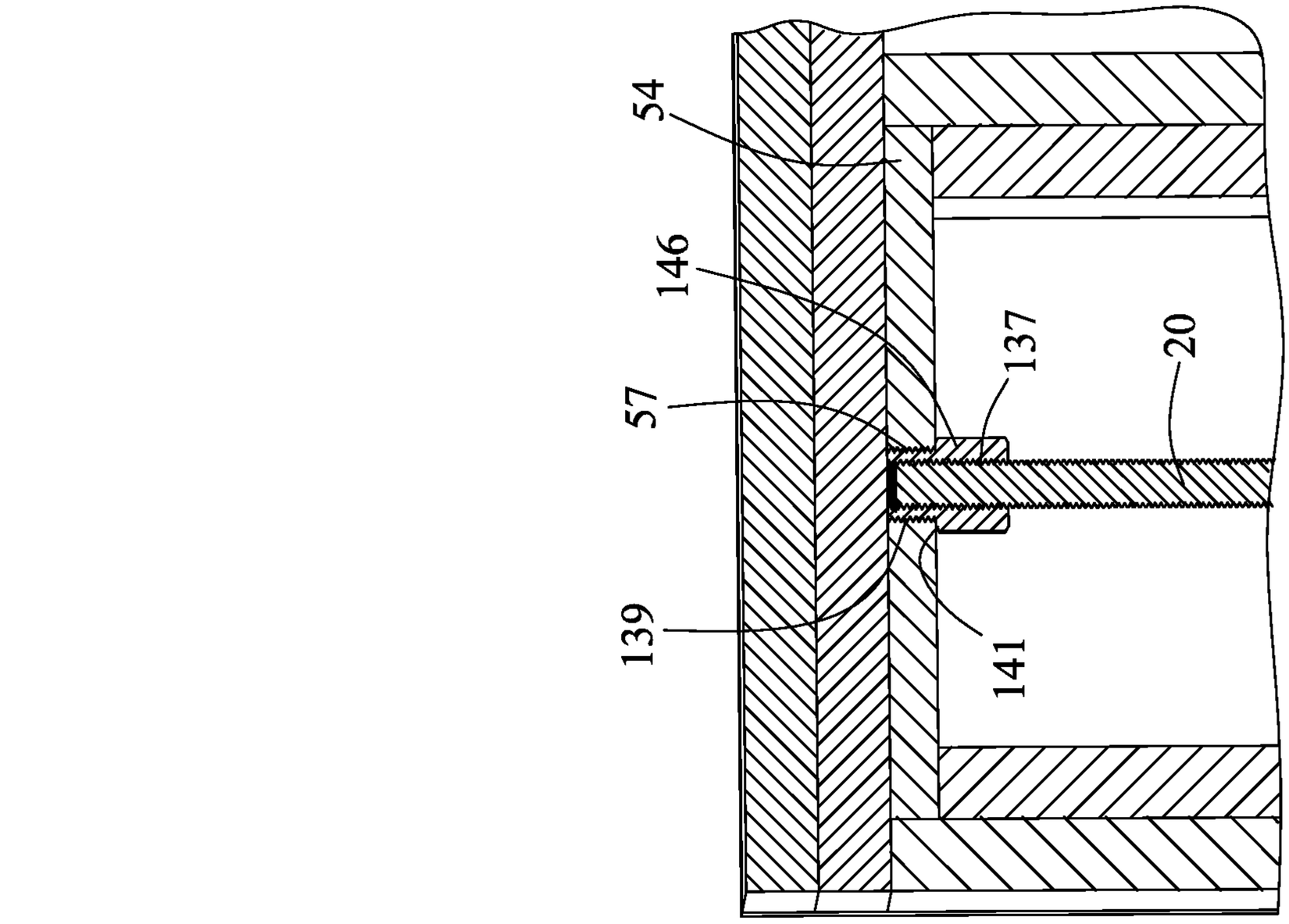


FIG. 94

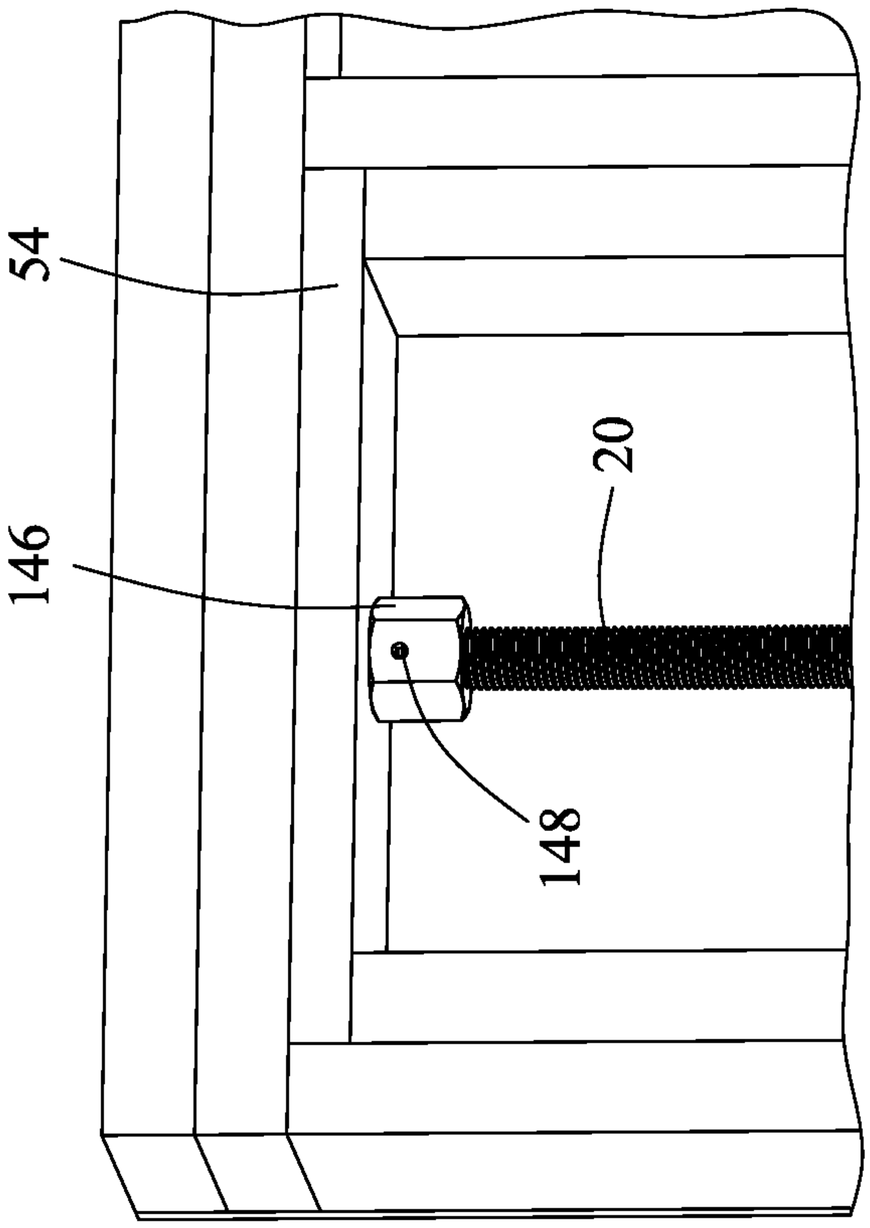


FIG. 93

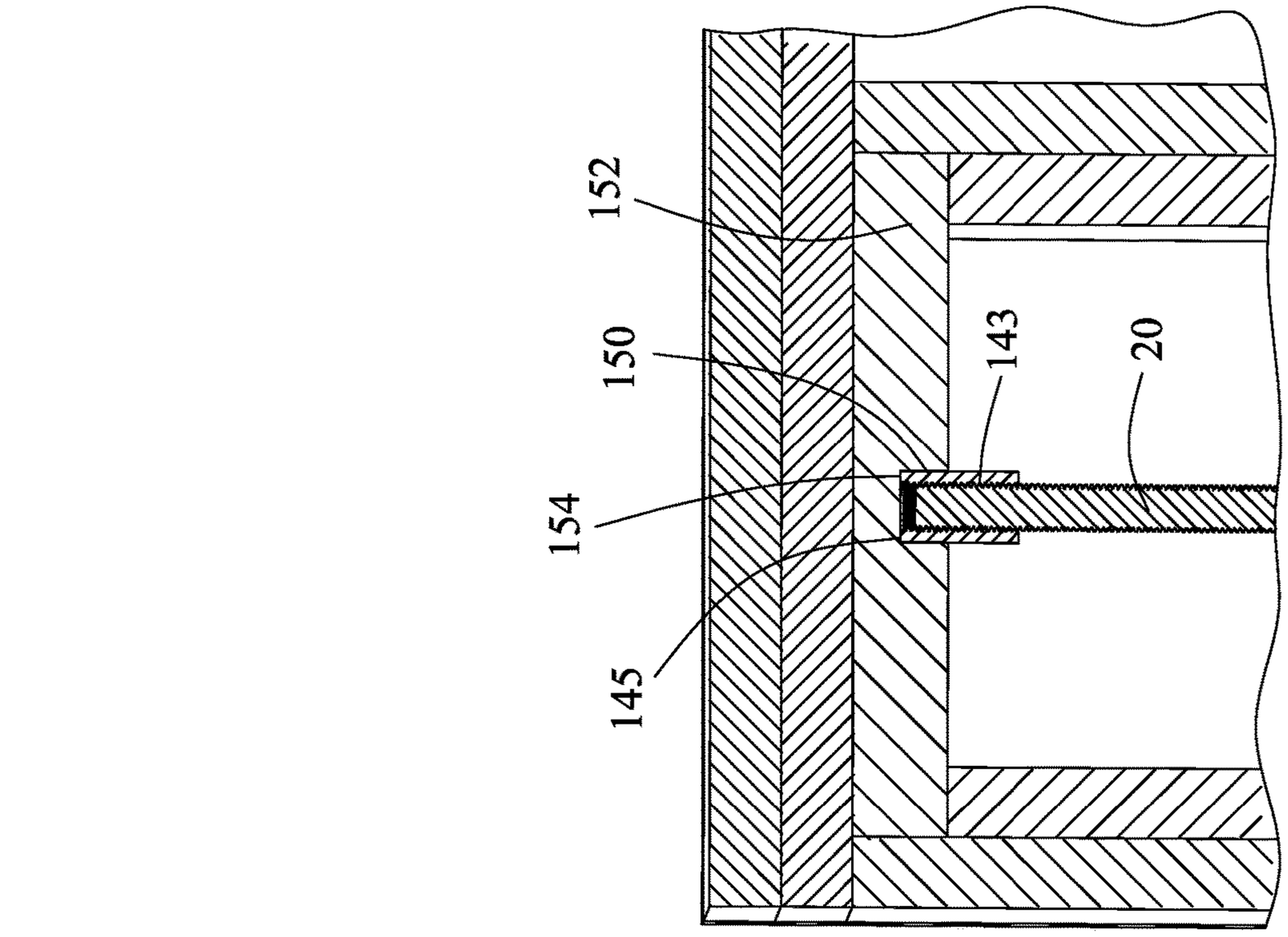


FIG. 96

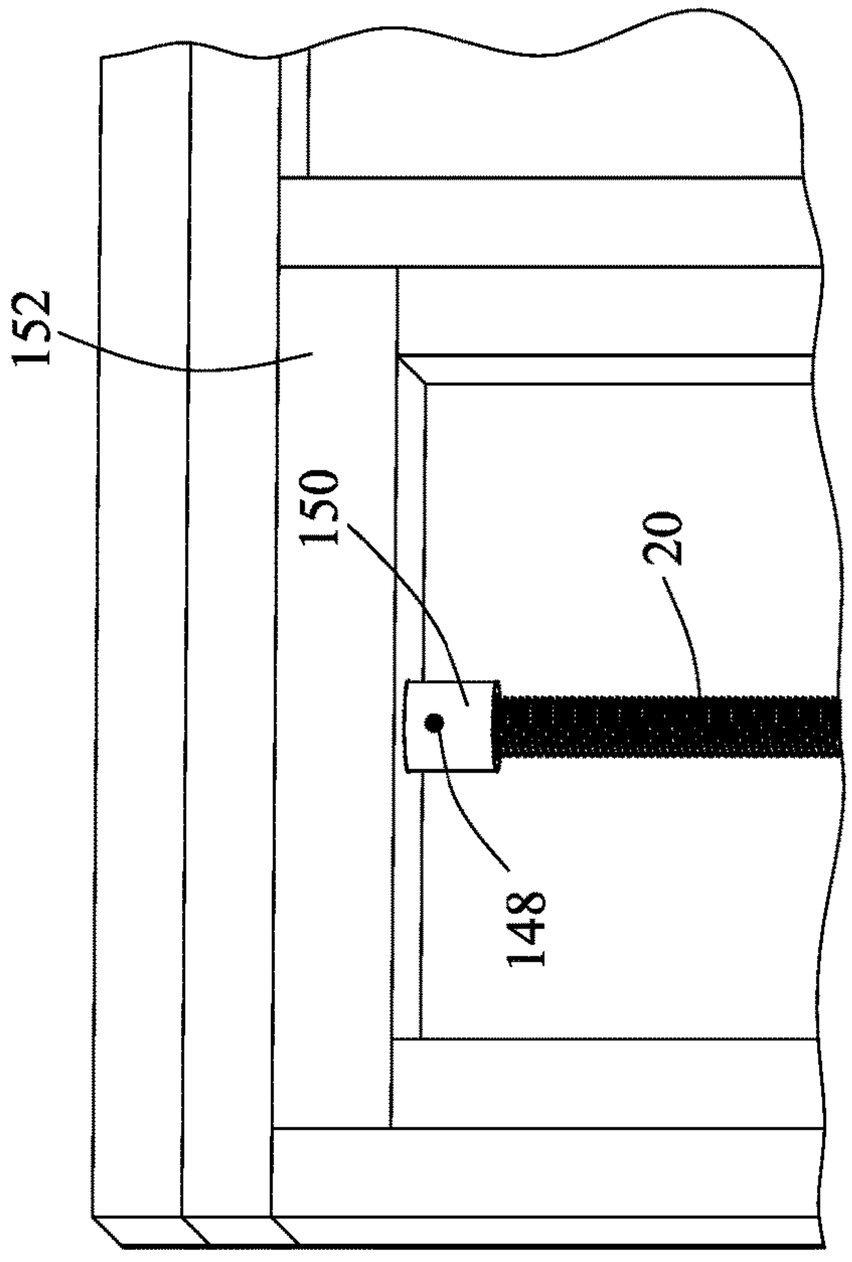


FIG. 95

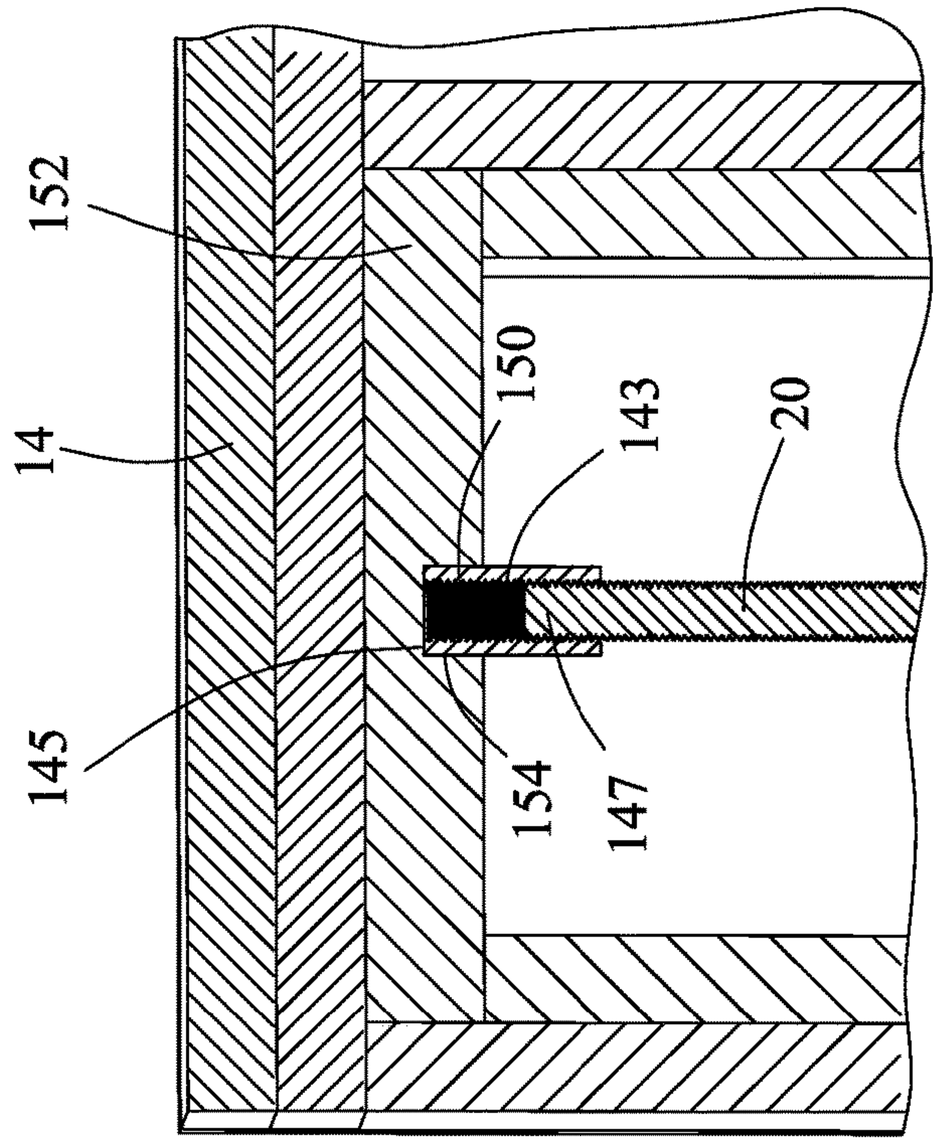


FIG. 98

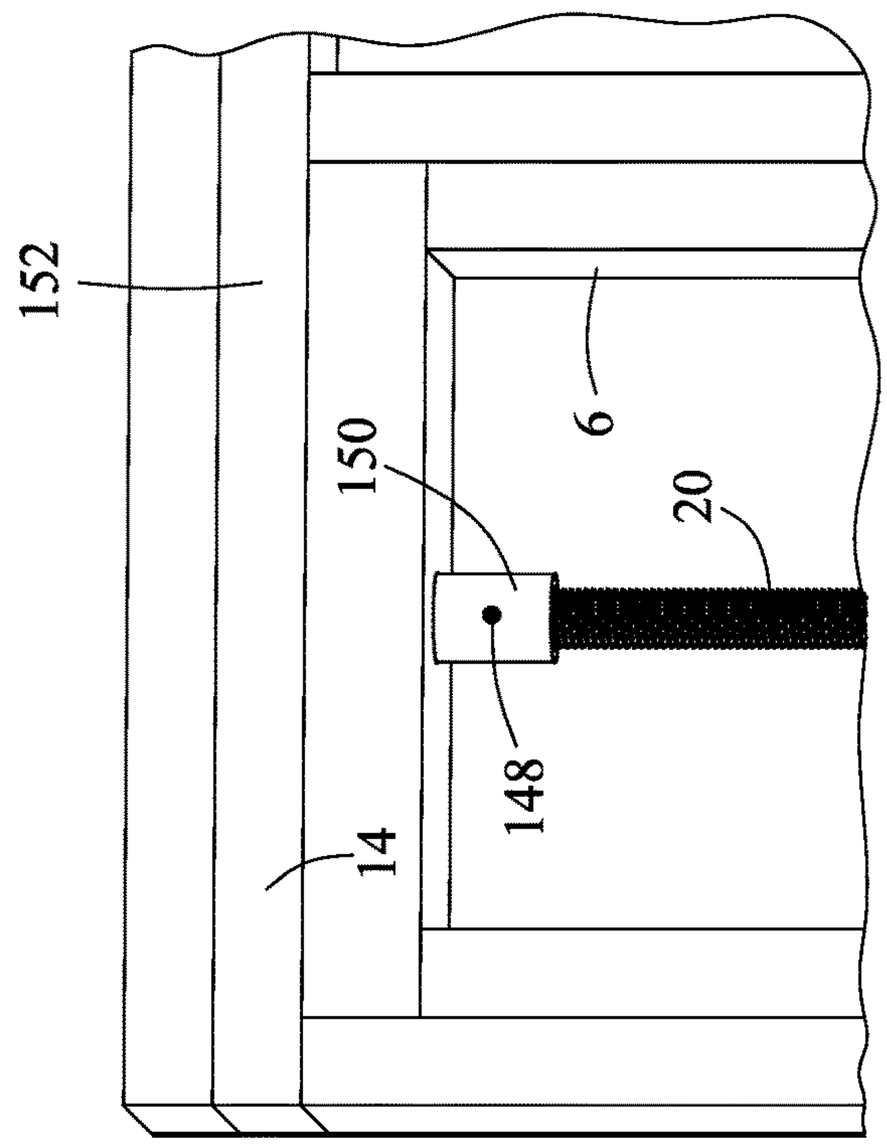


FIG. 97

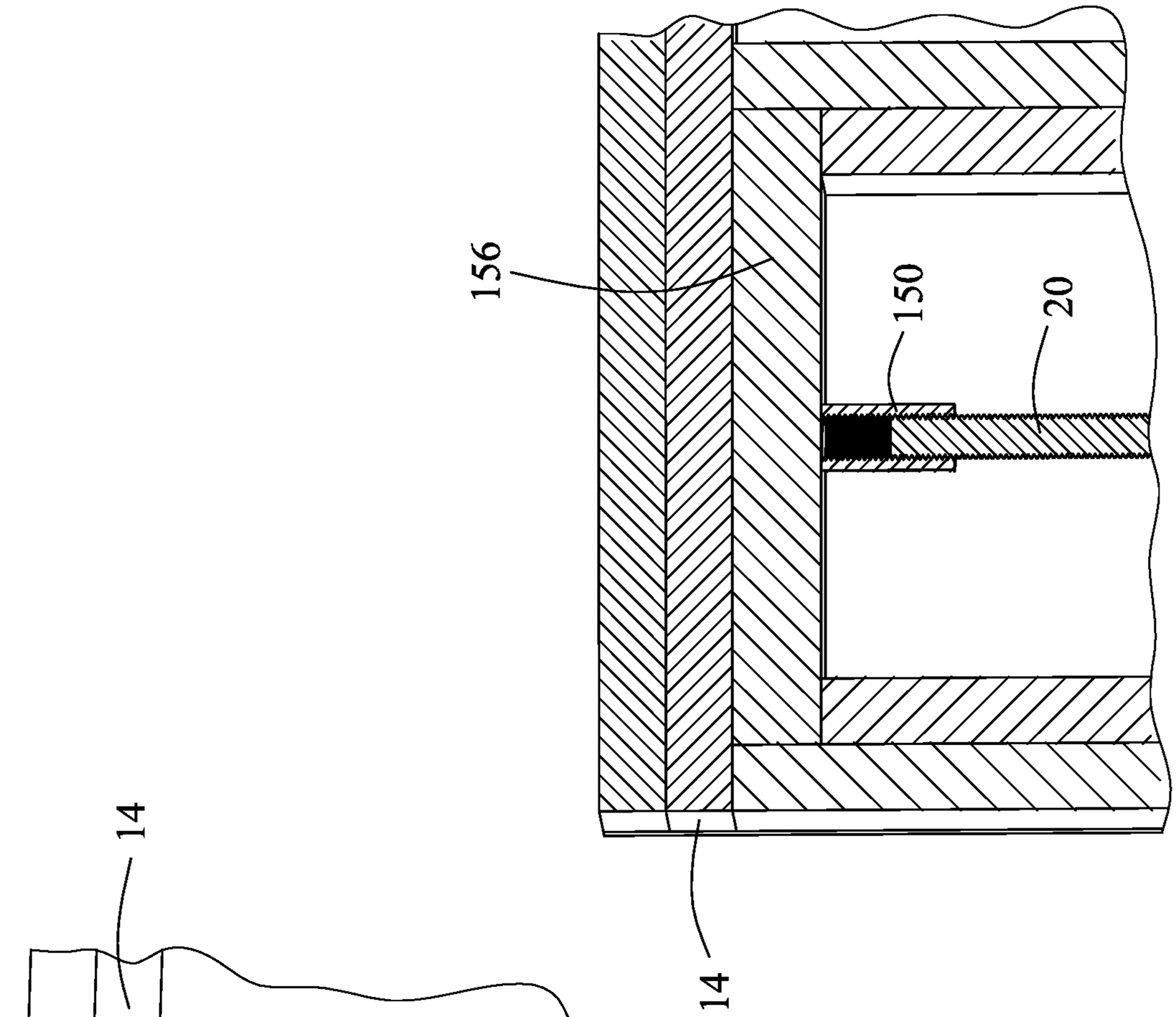


FIG. 100

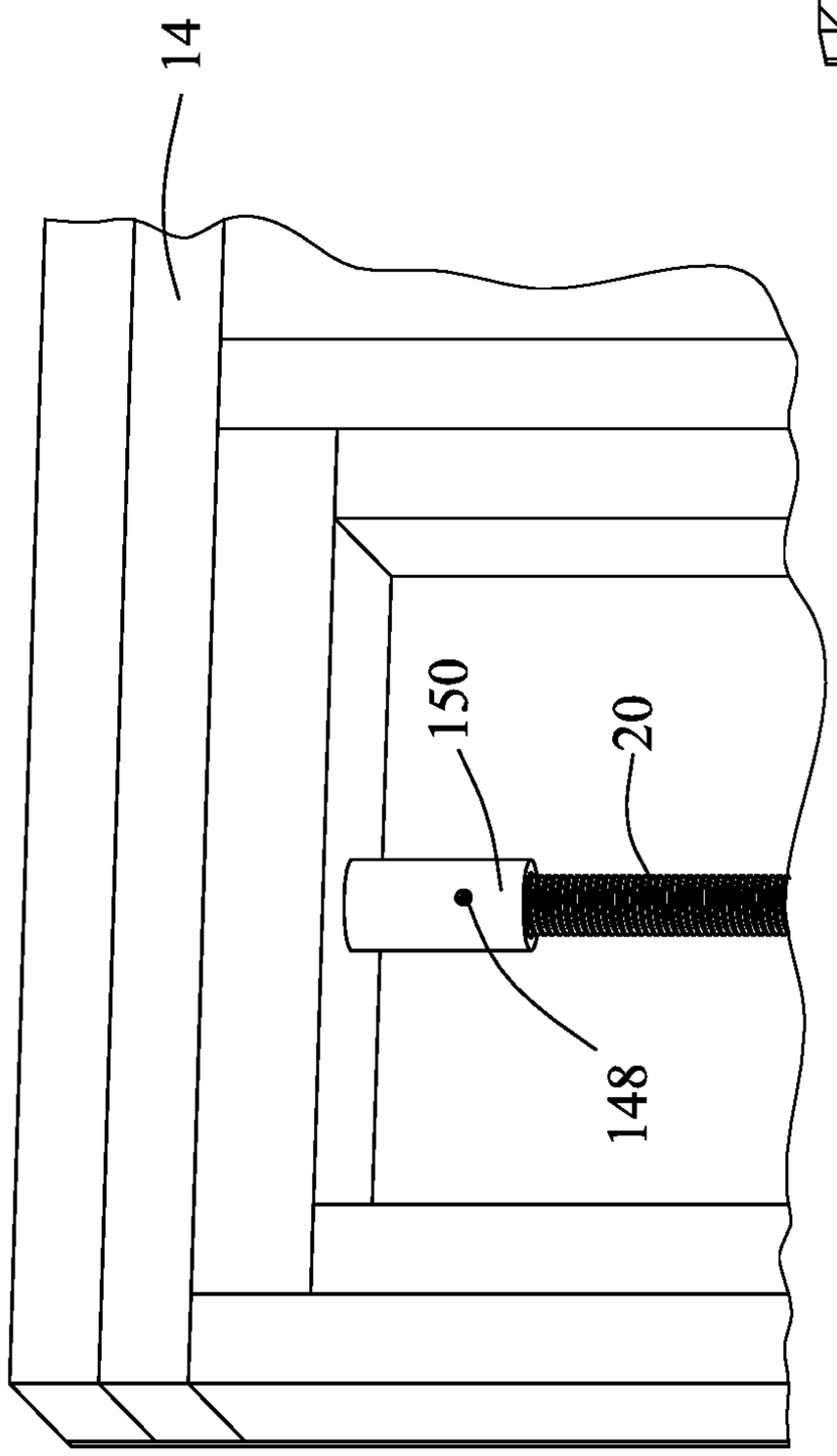


FIG. 99

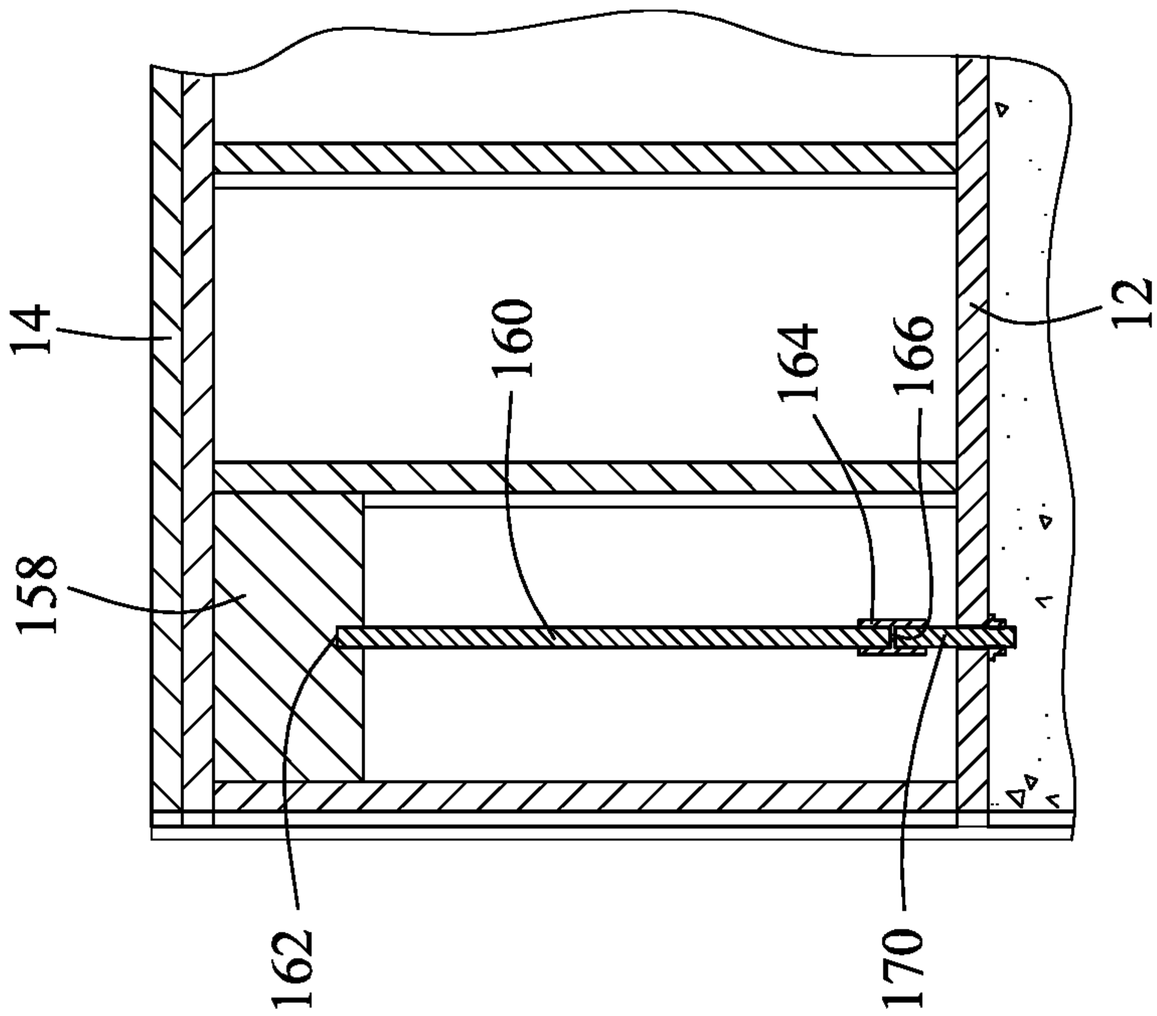


FIG. 102

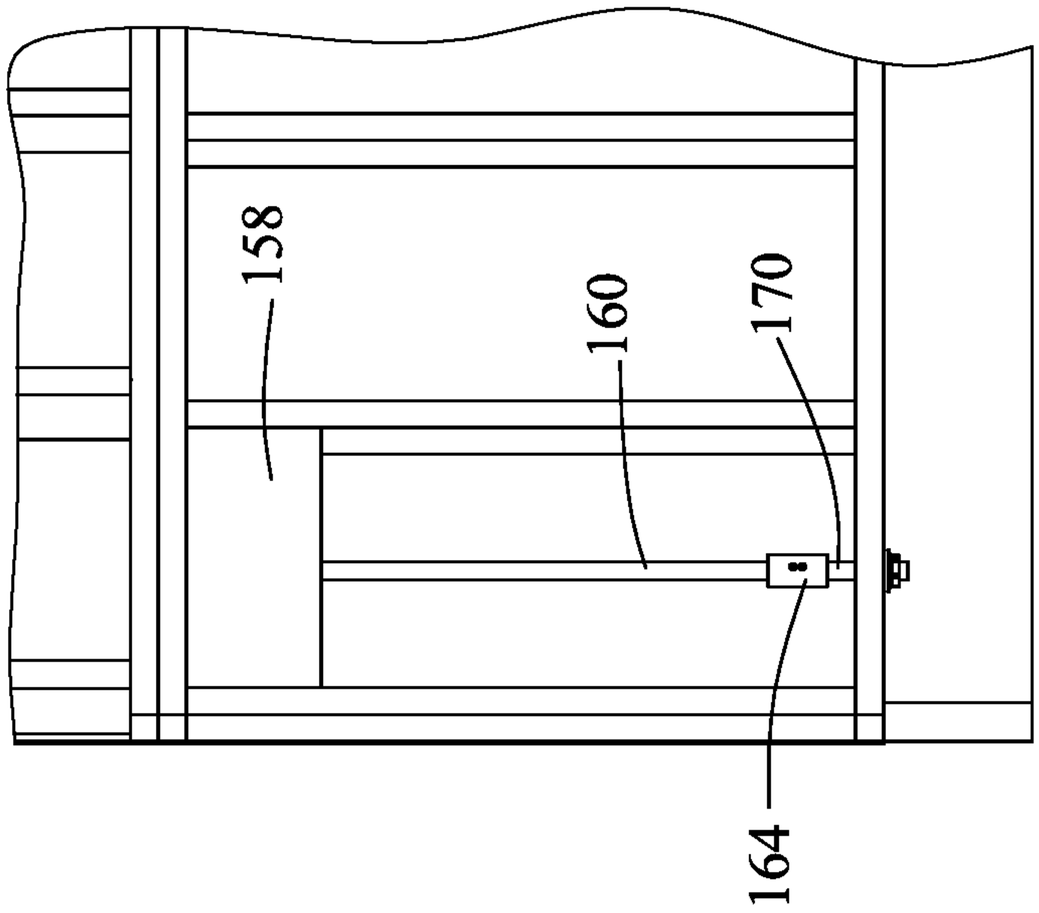


FIG. 101

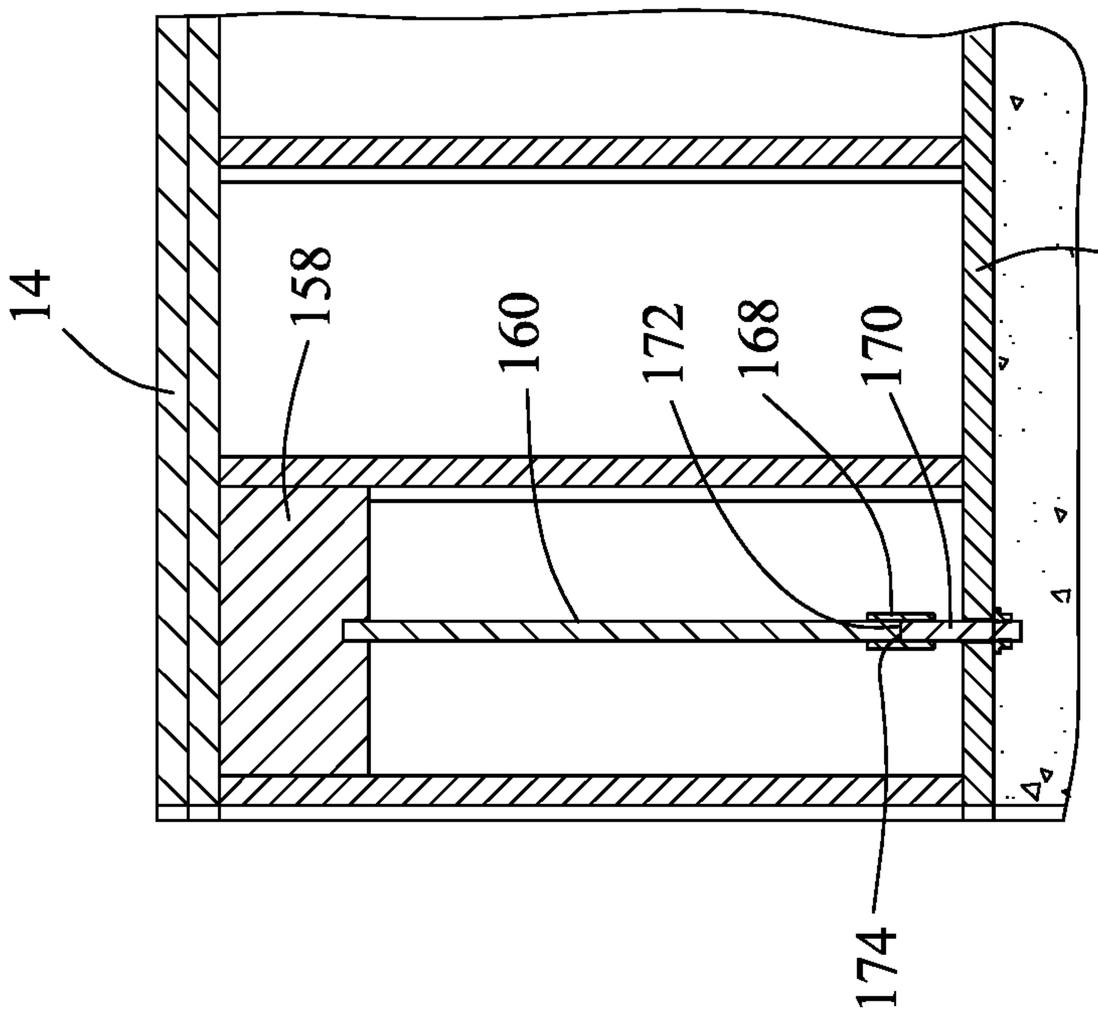


FIG. 104

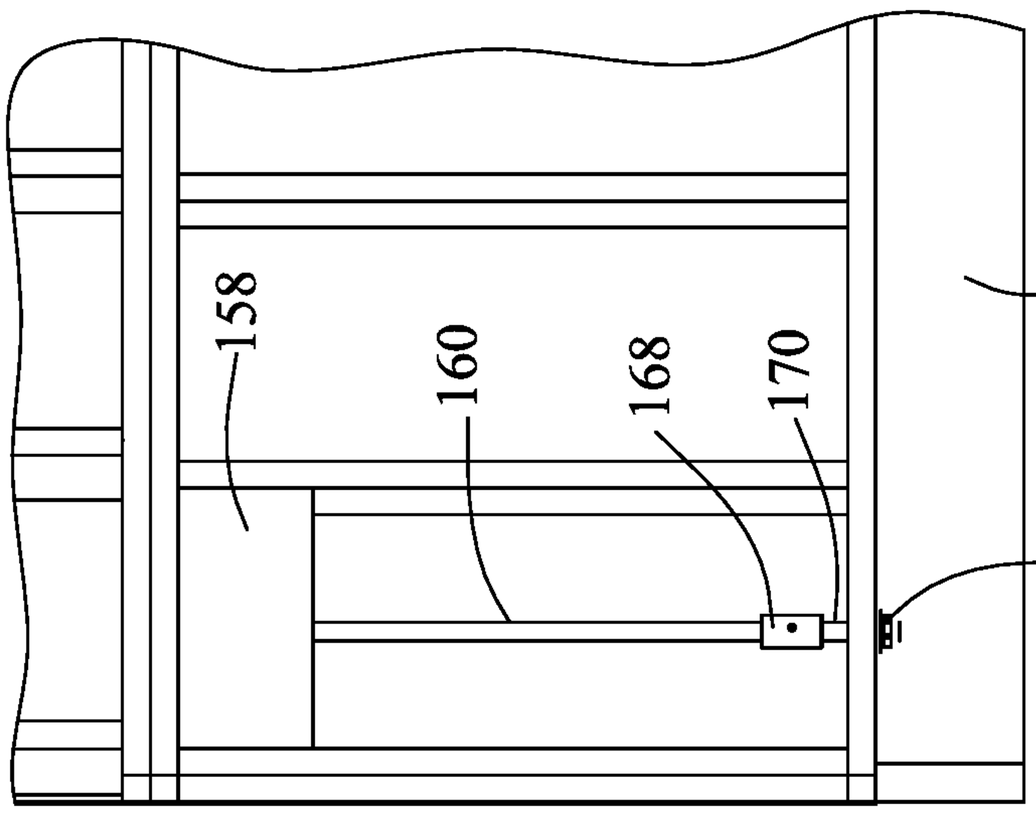


FIG. 103

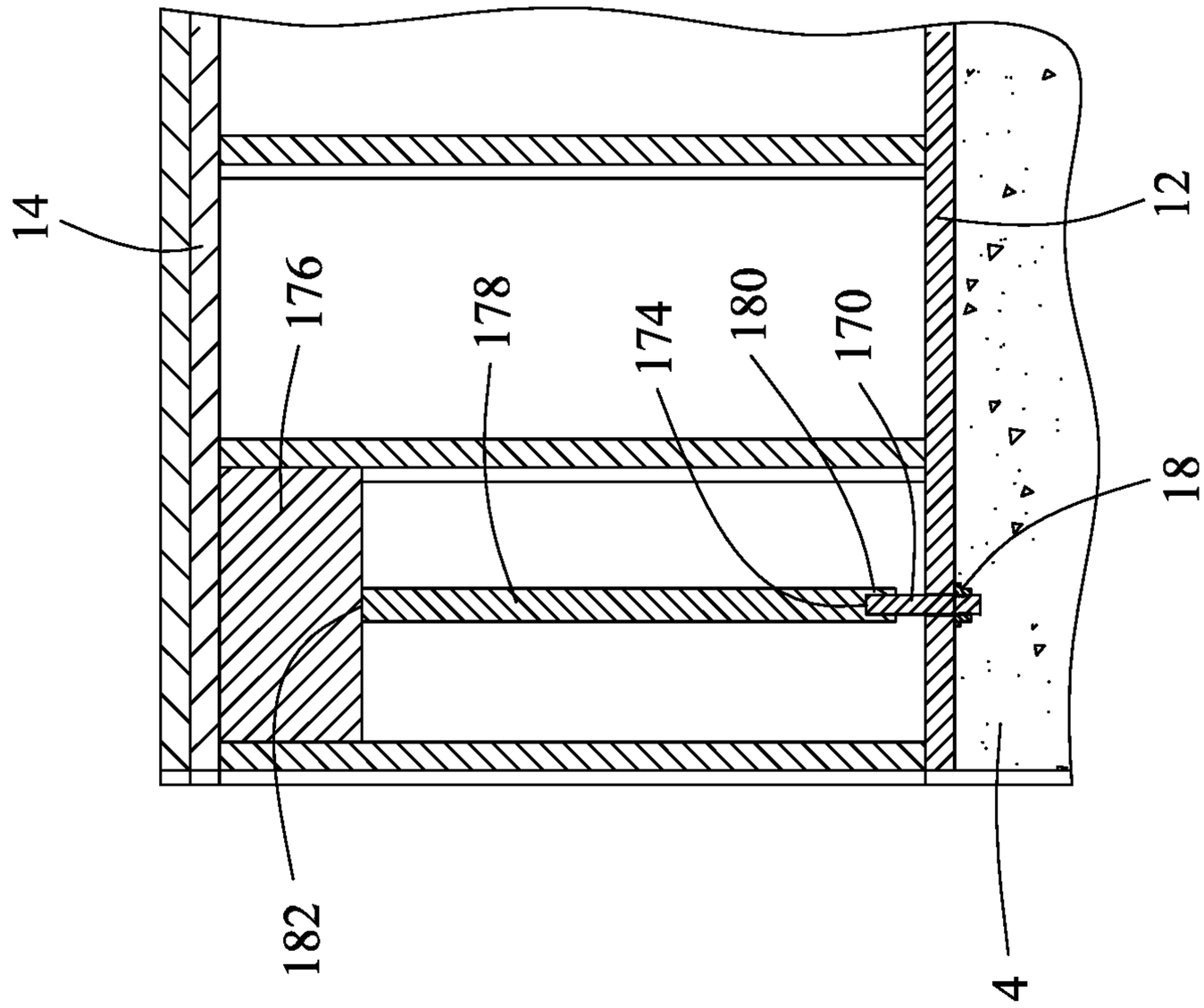


FIG. 106

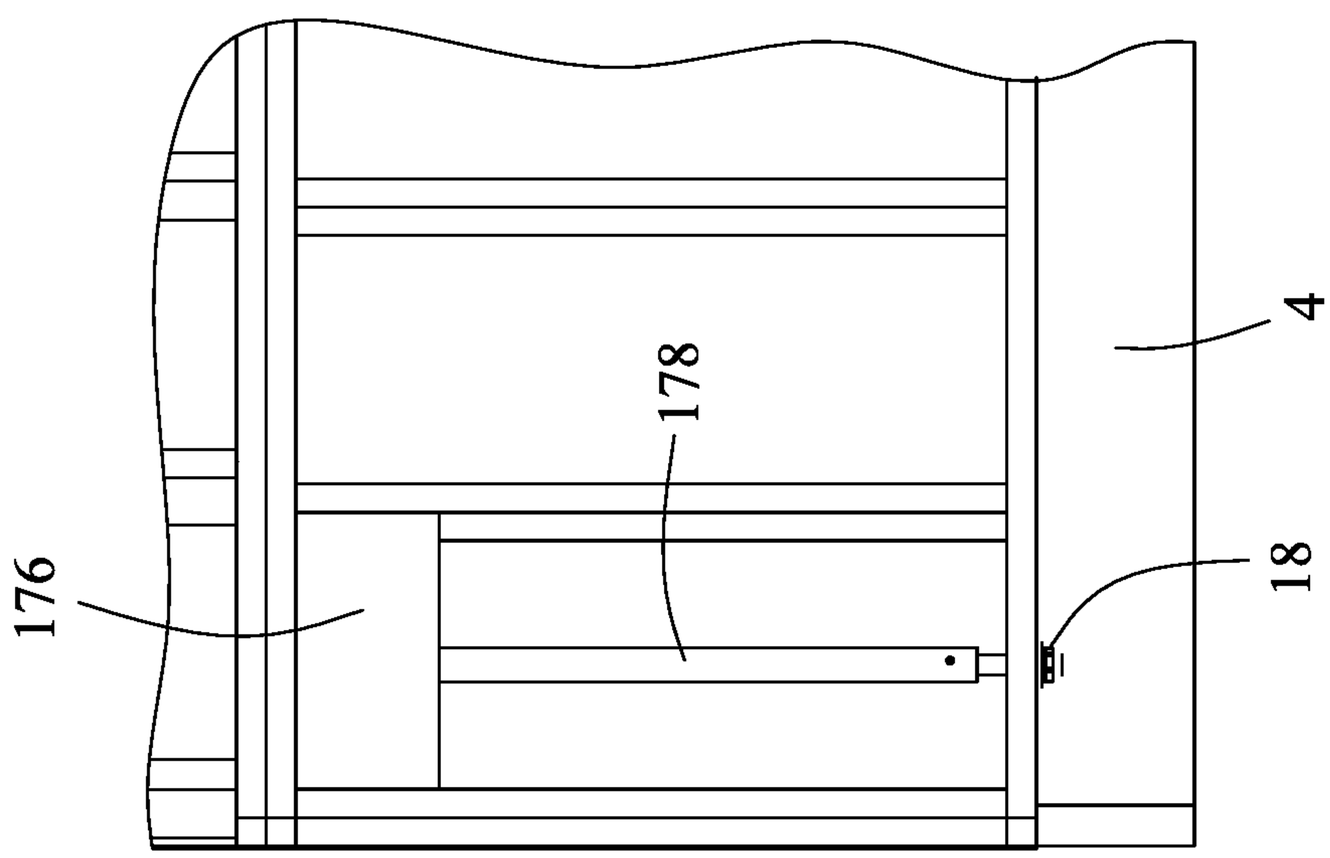


FIG. 105

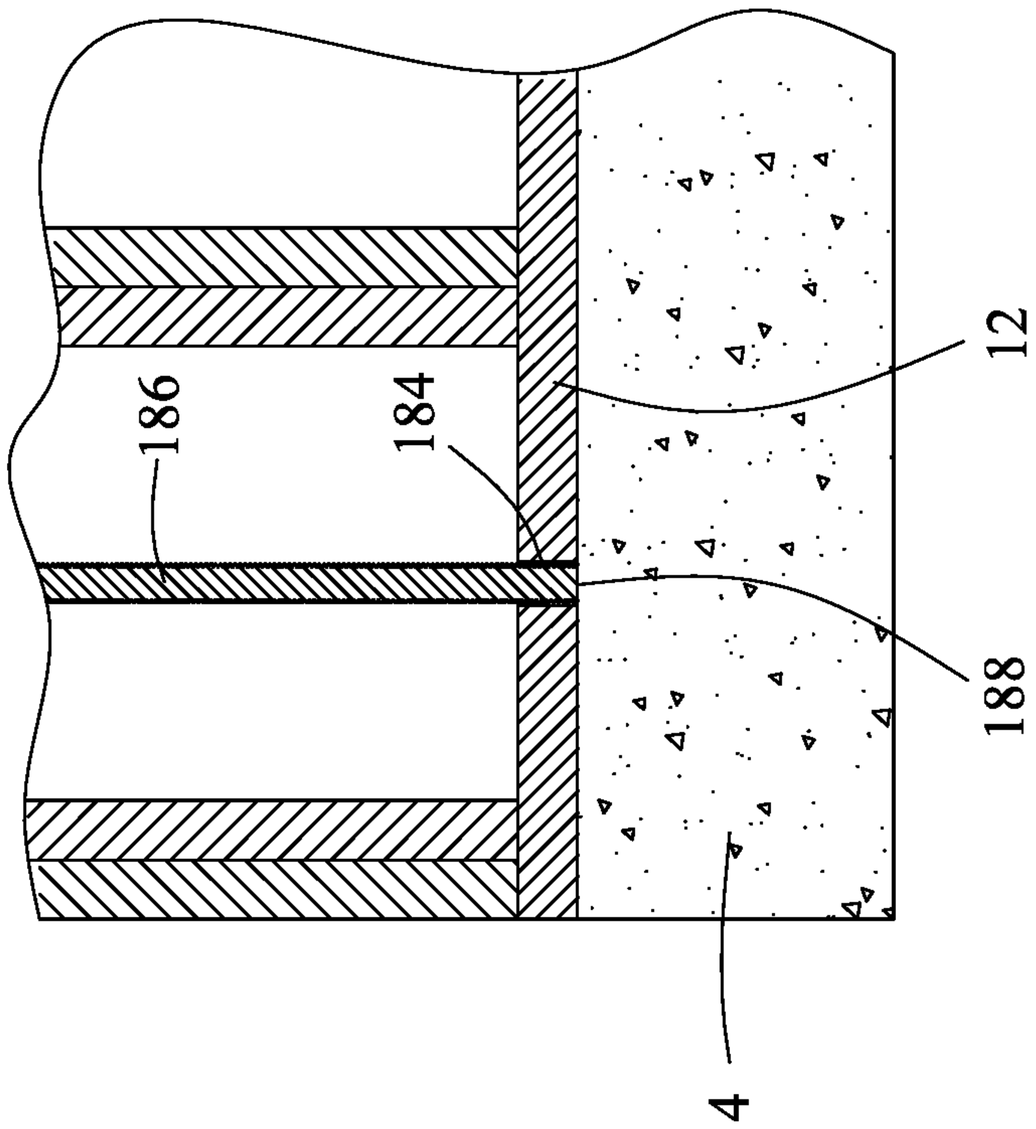


FIG. 108

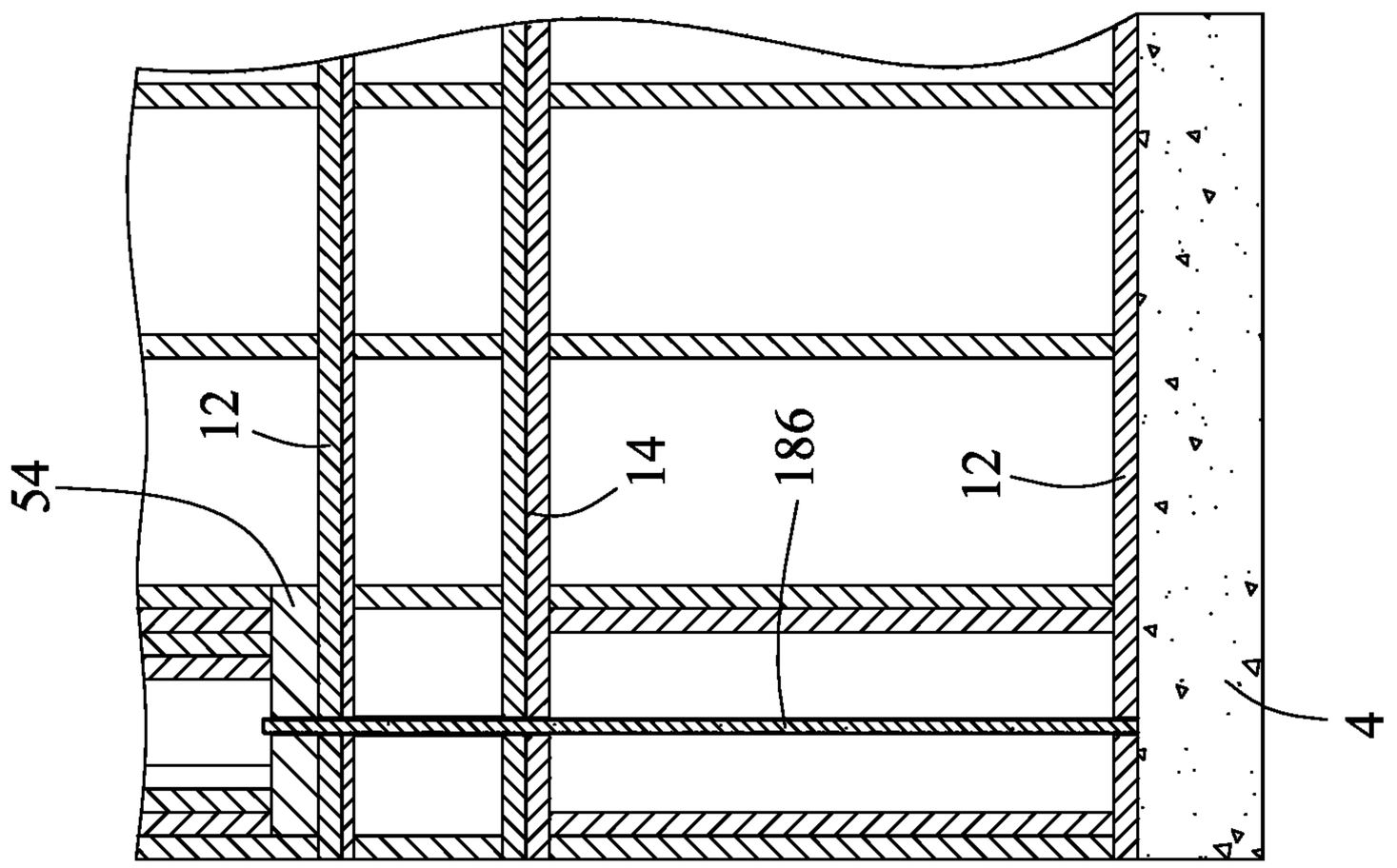


FIG. 107

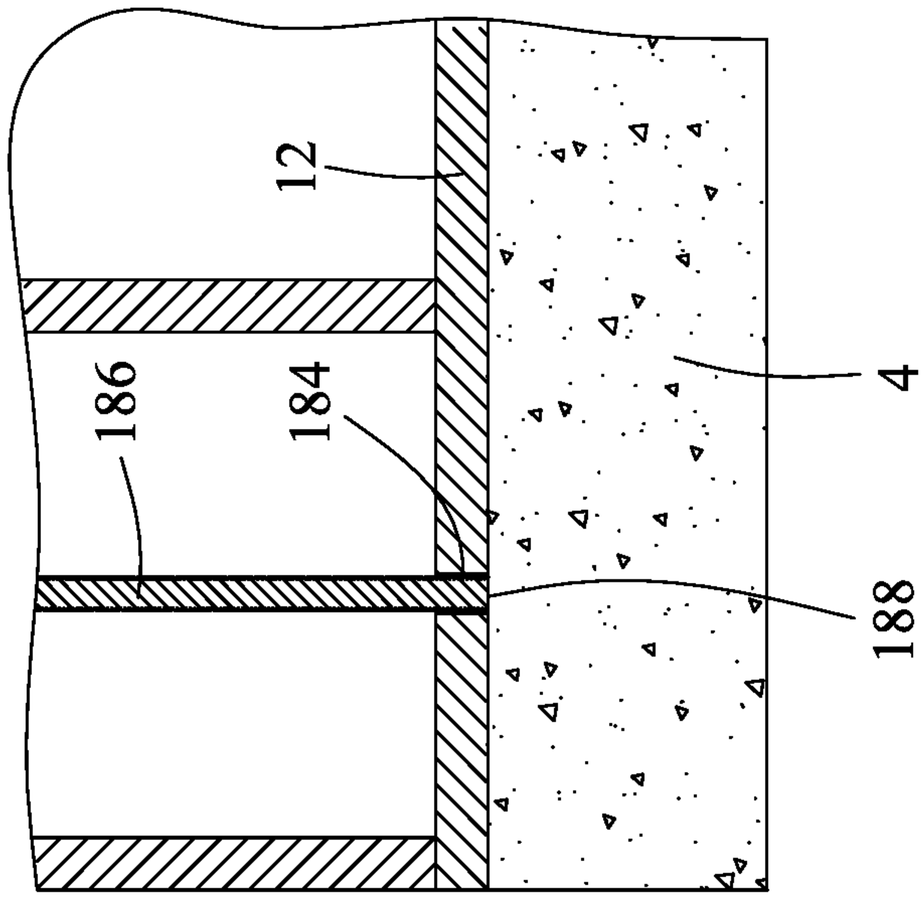


FIG. 110

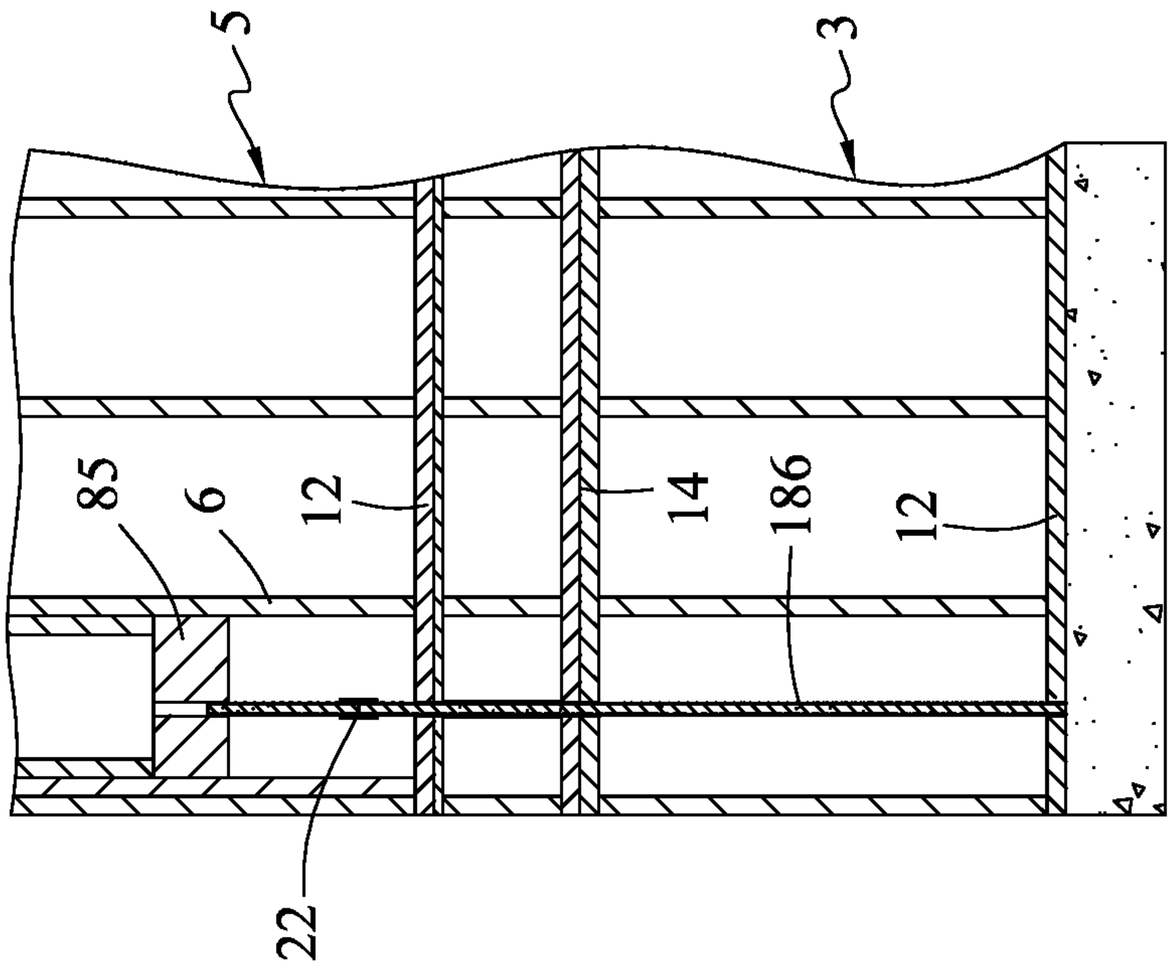


FIG. 109

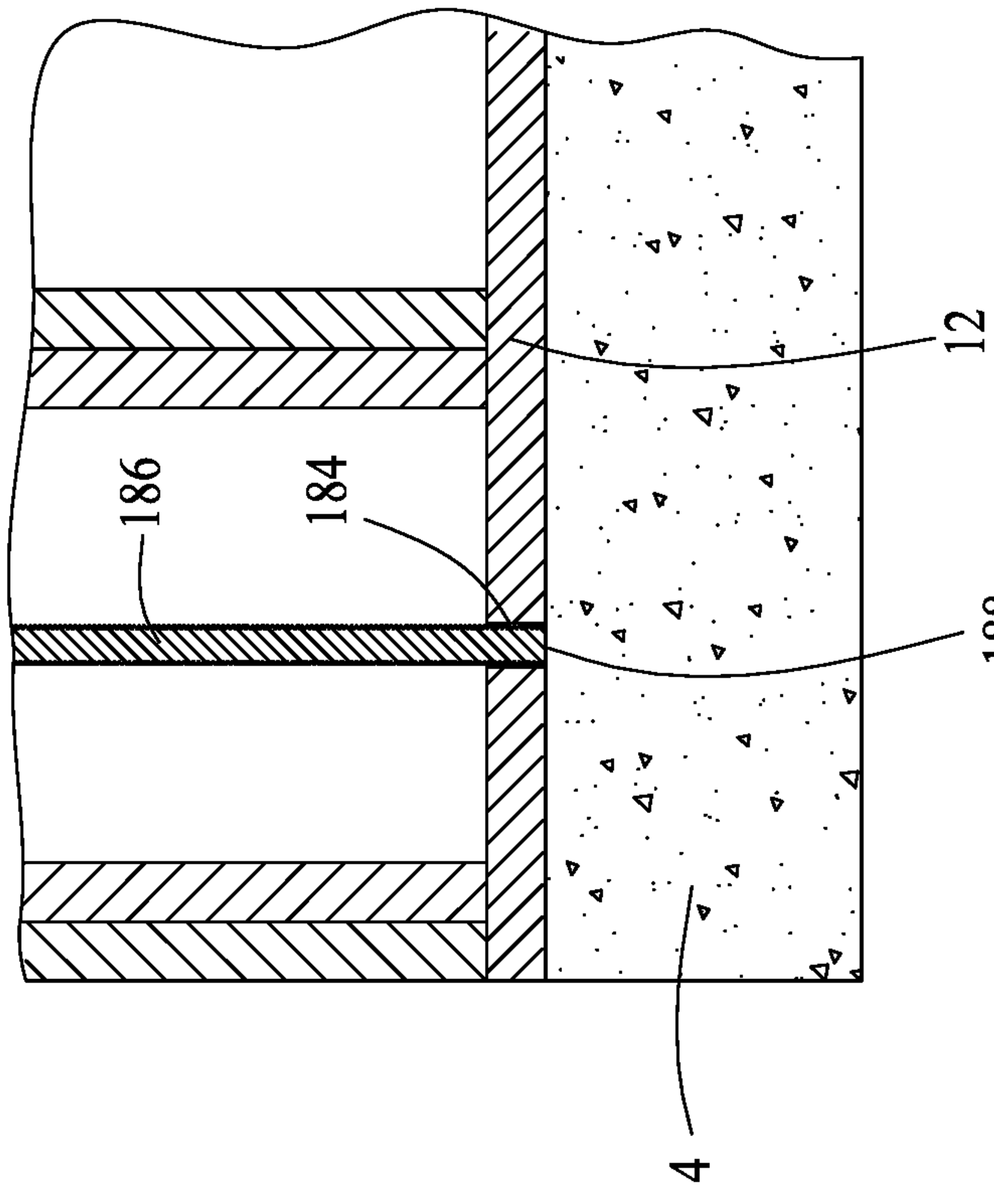


FIG. 112

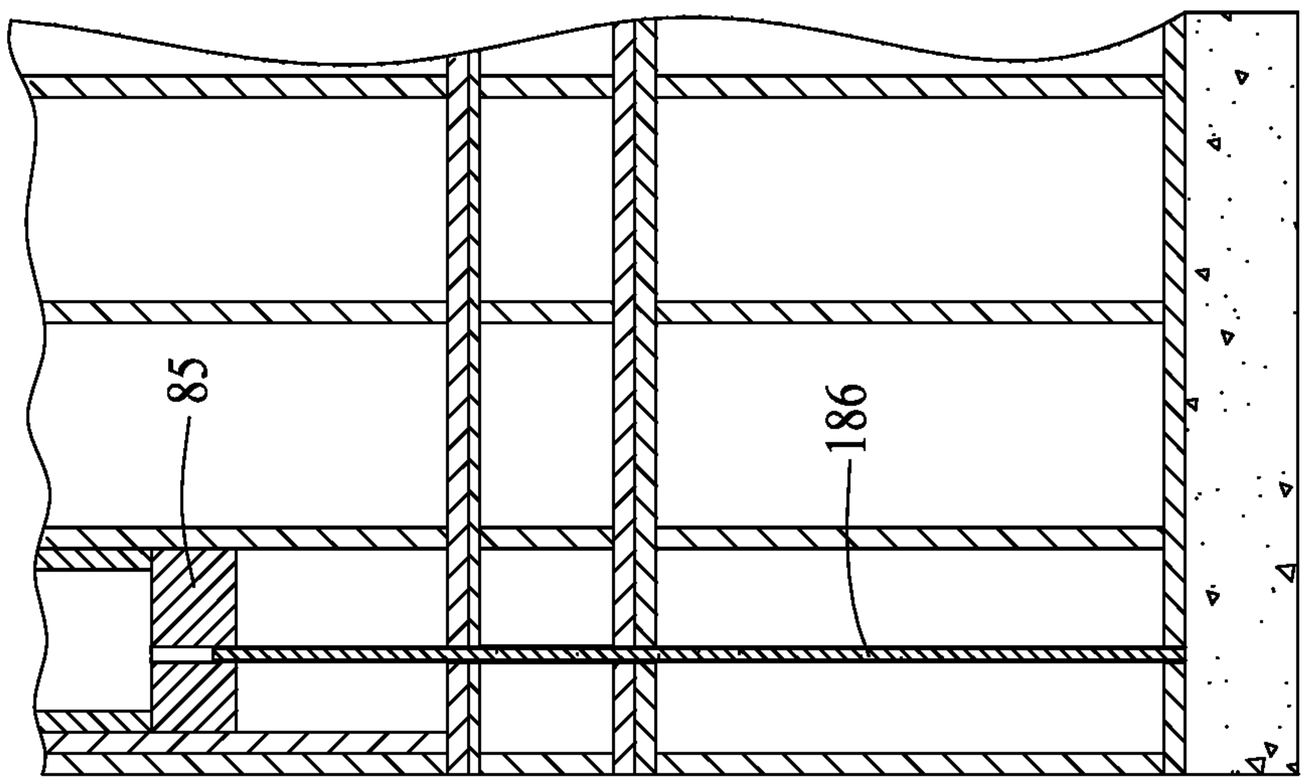
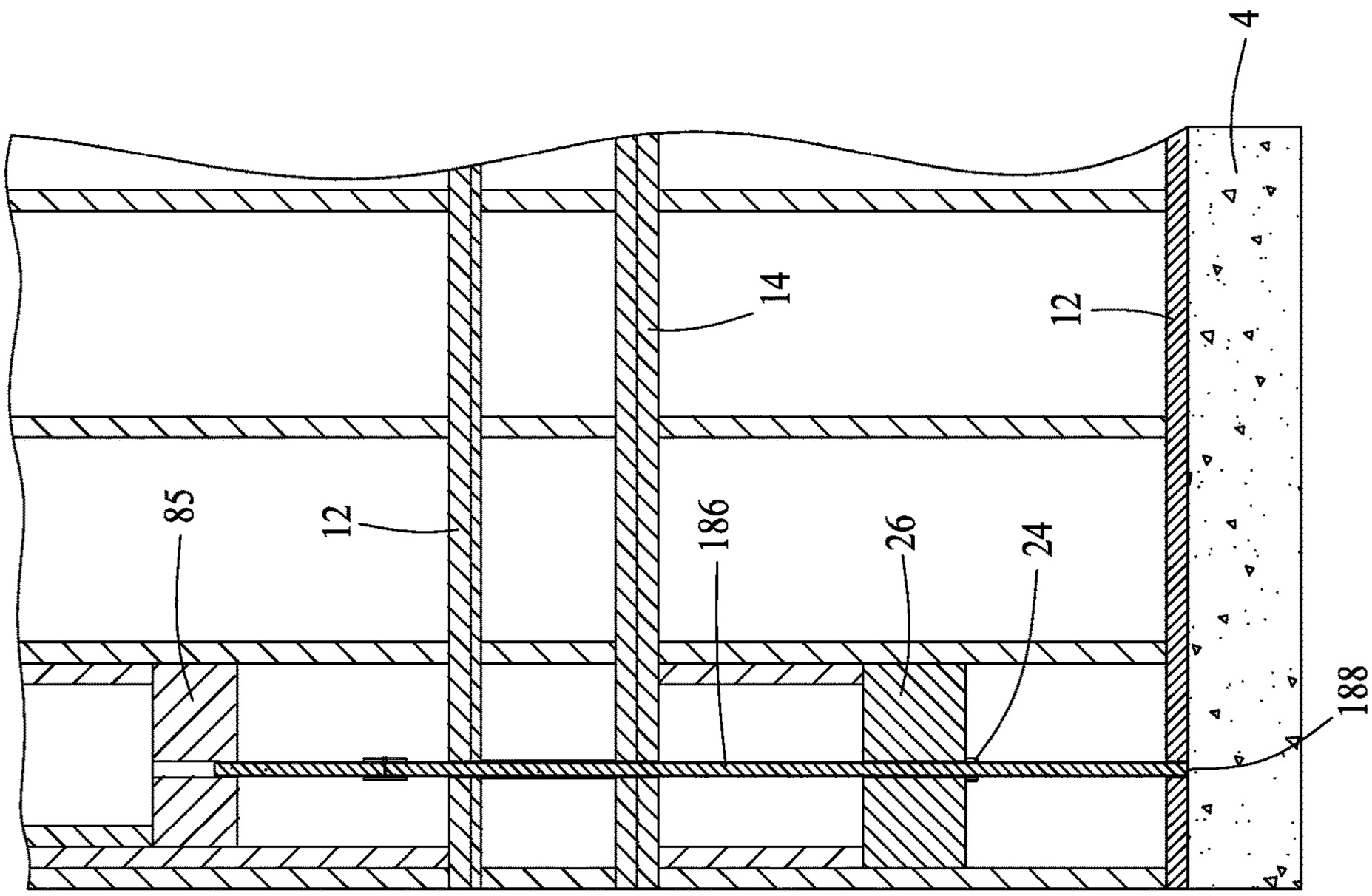


FIG. 111

FIG. 113



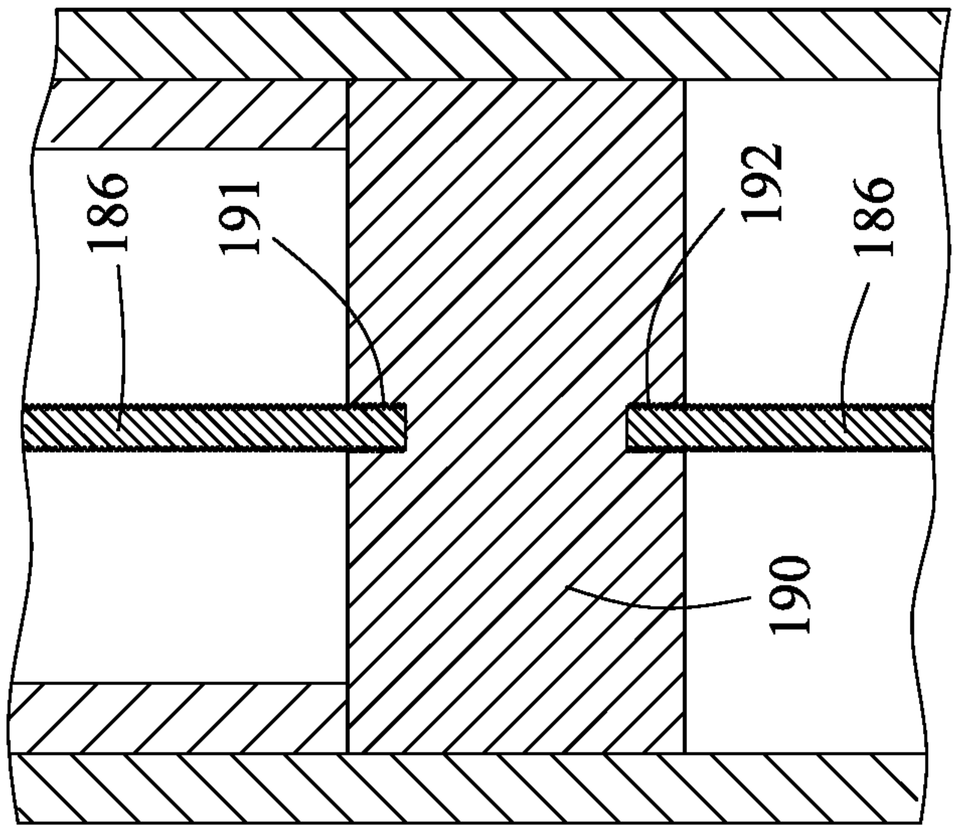


FIG. 115

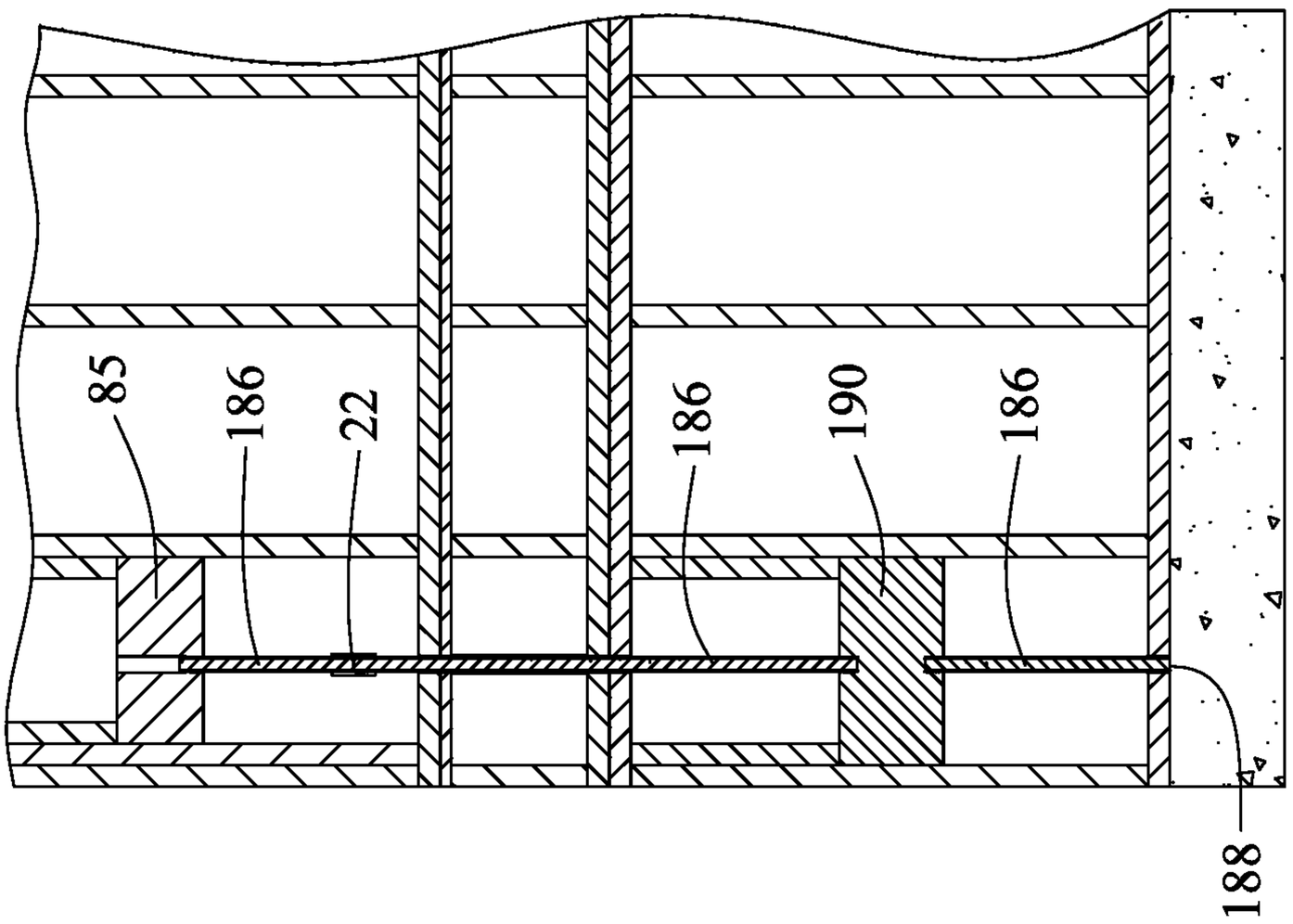


FIG. 114

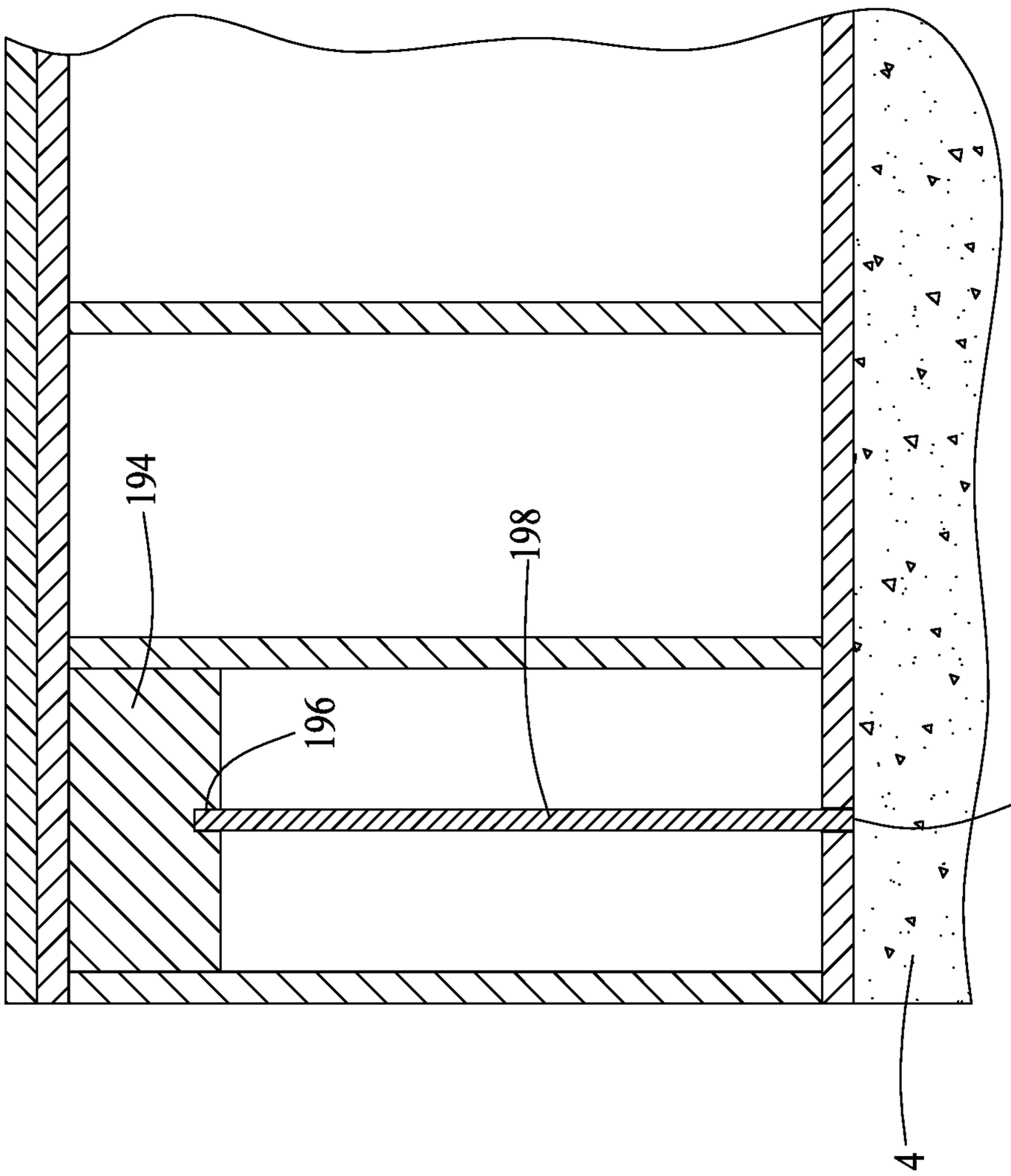


FIG. 116

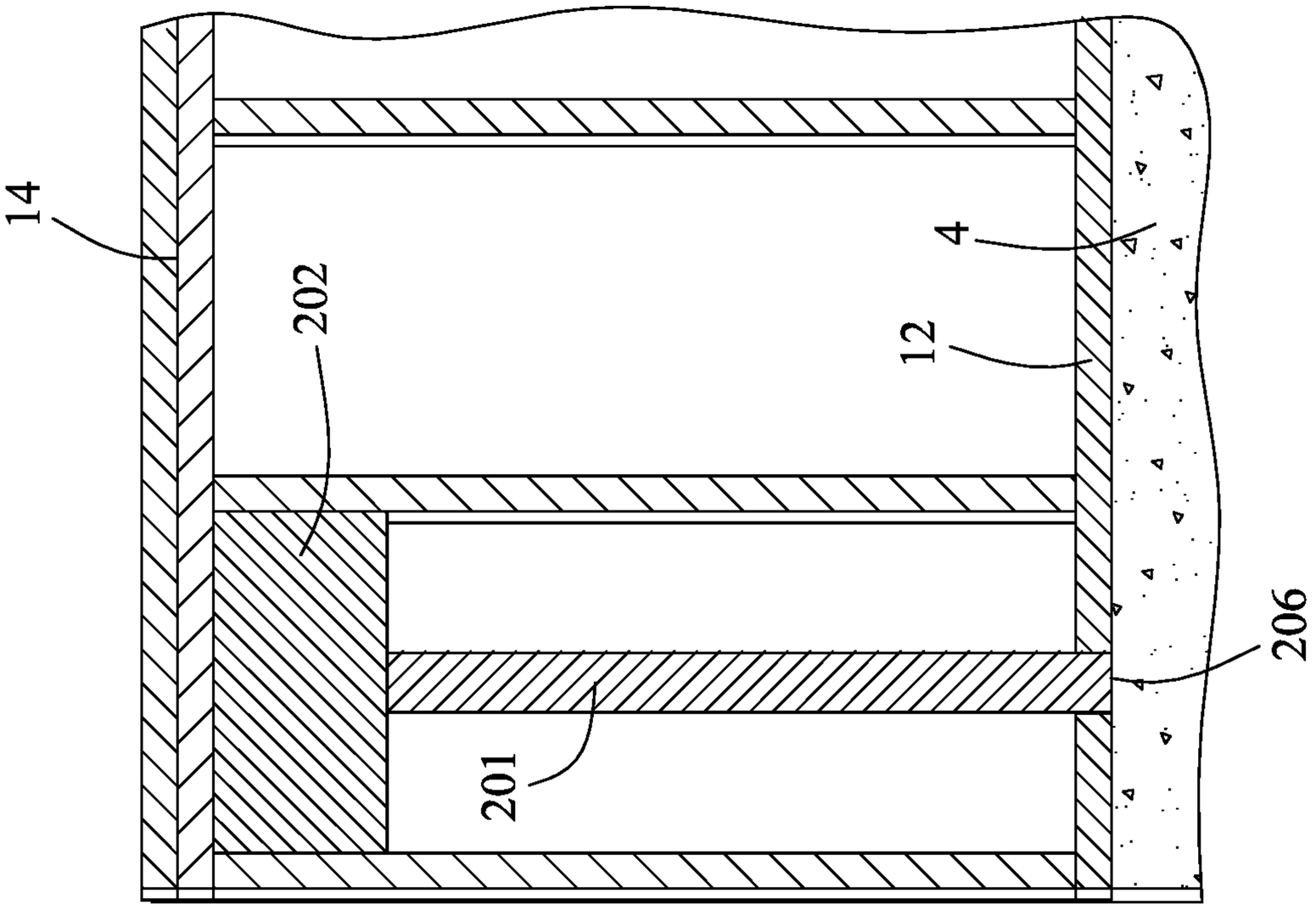


FIG. 118

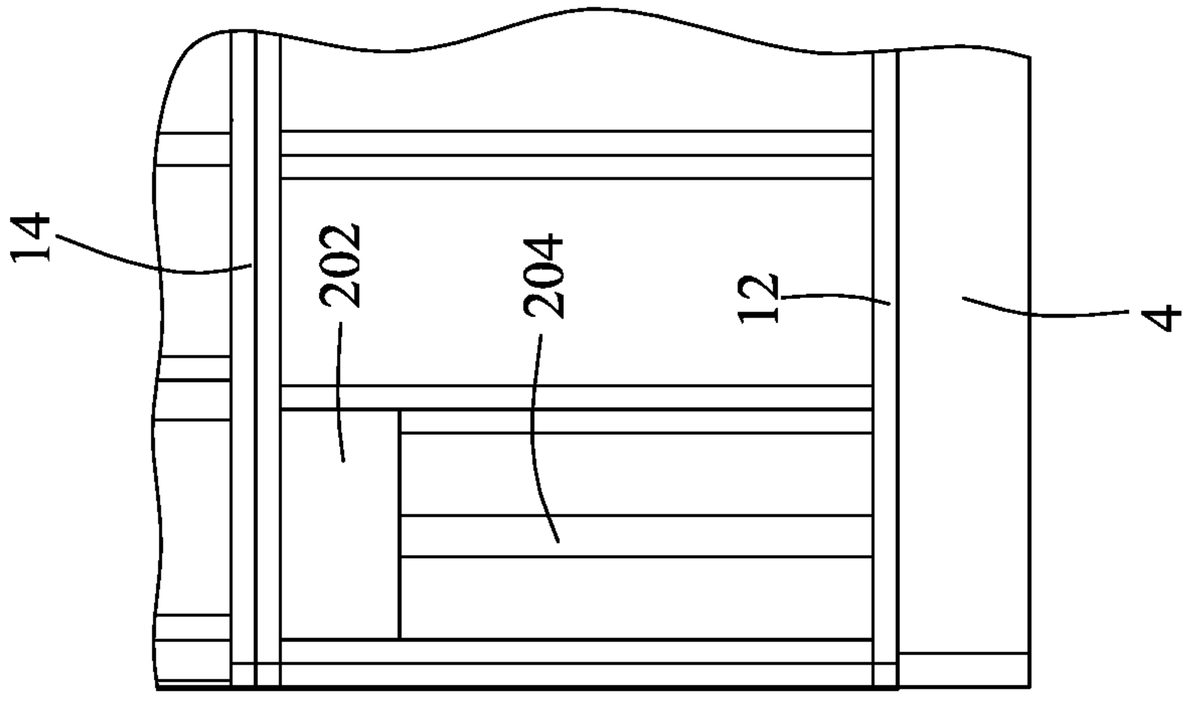


FIG. 117

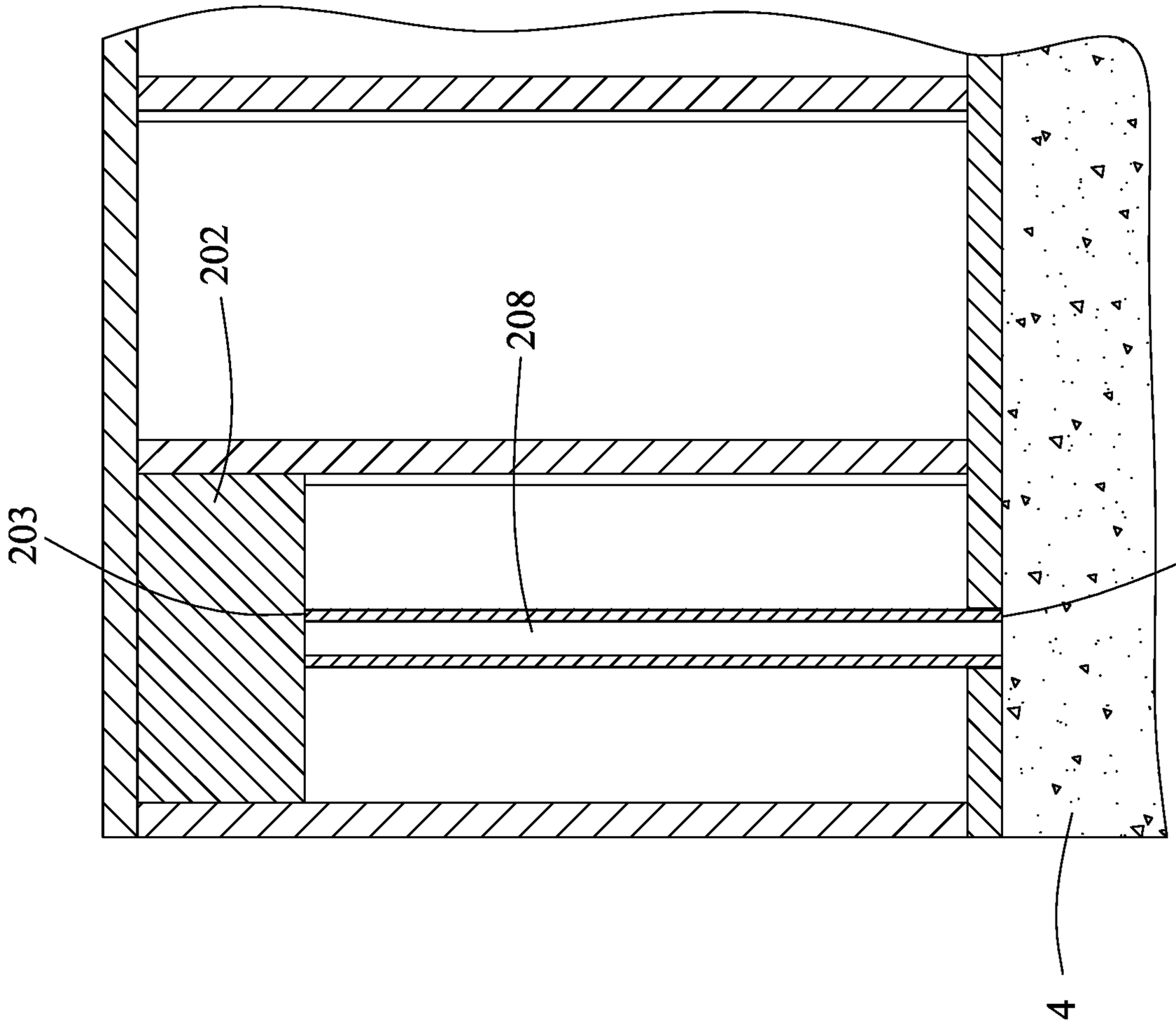


FIG. 119

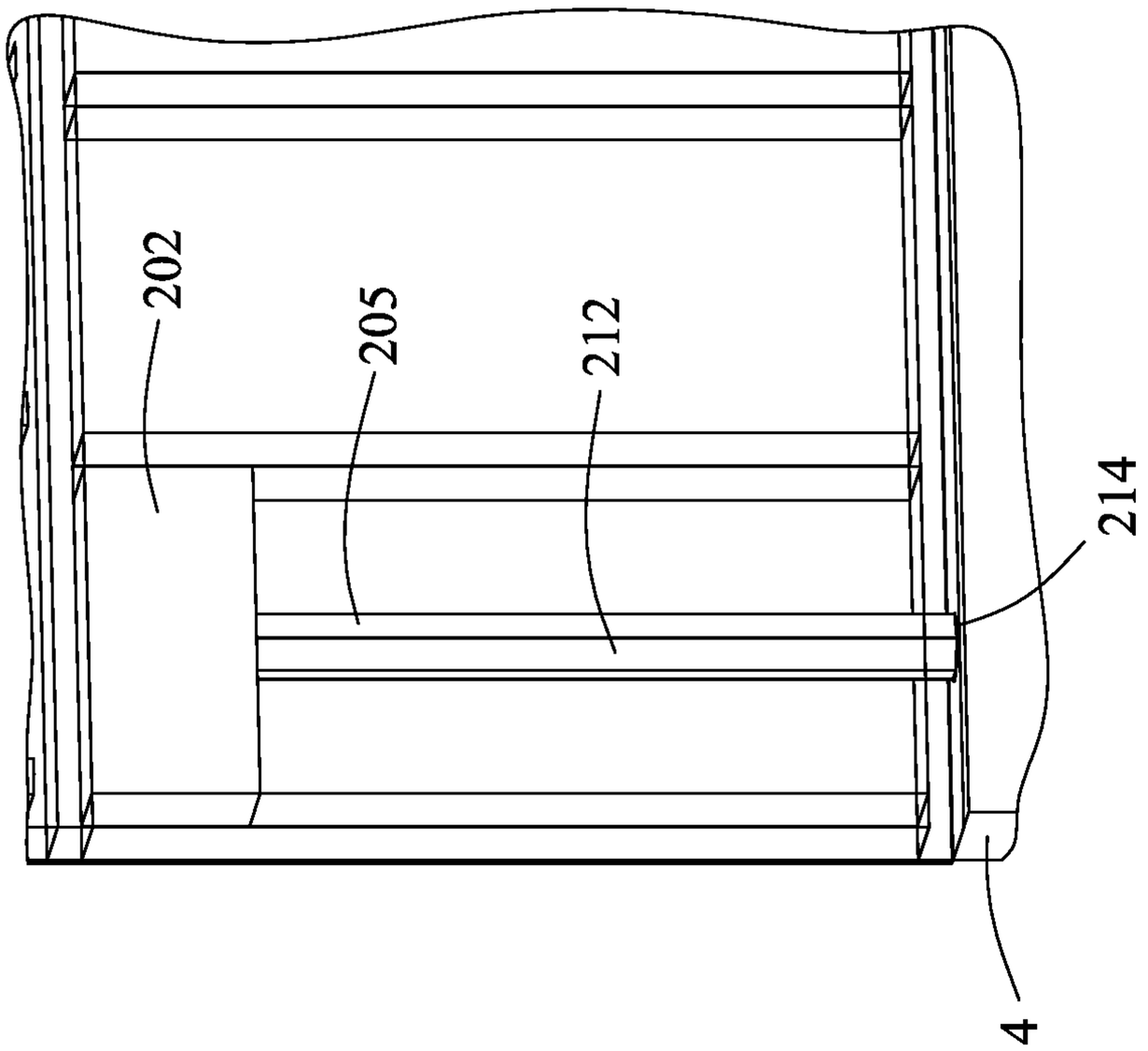


FIG. 121

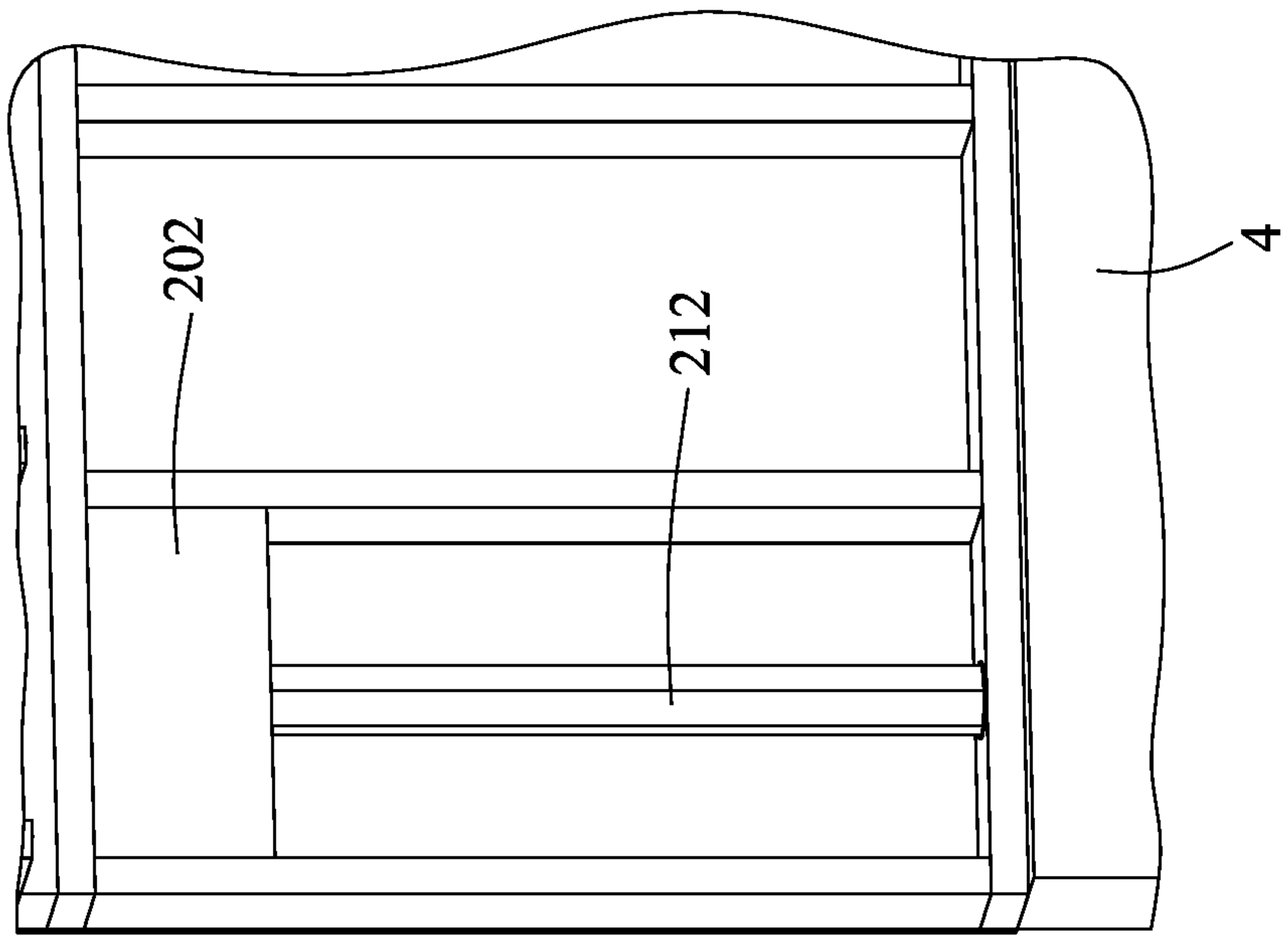


FIG. 120

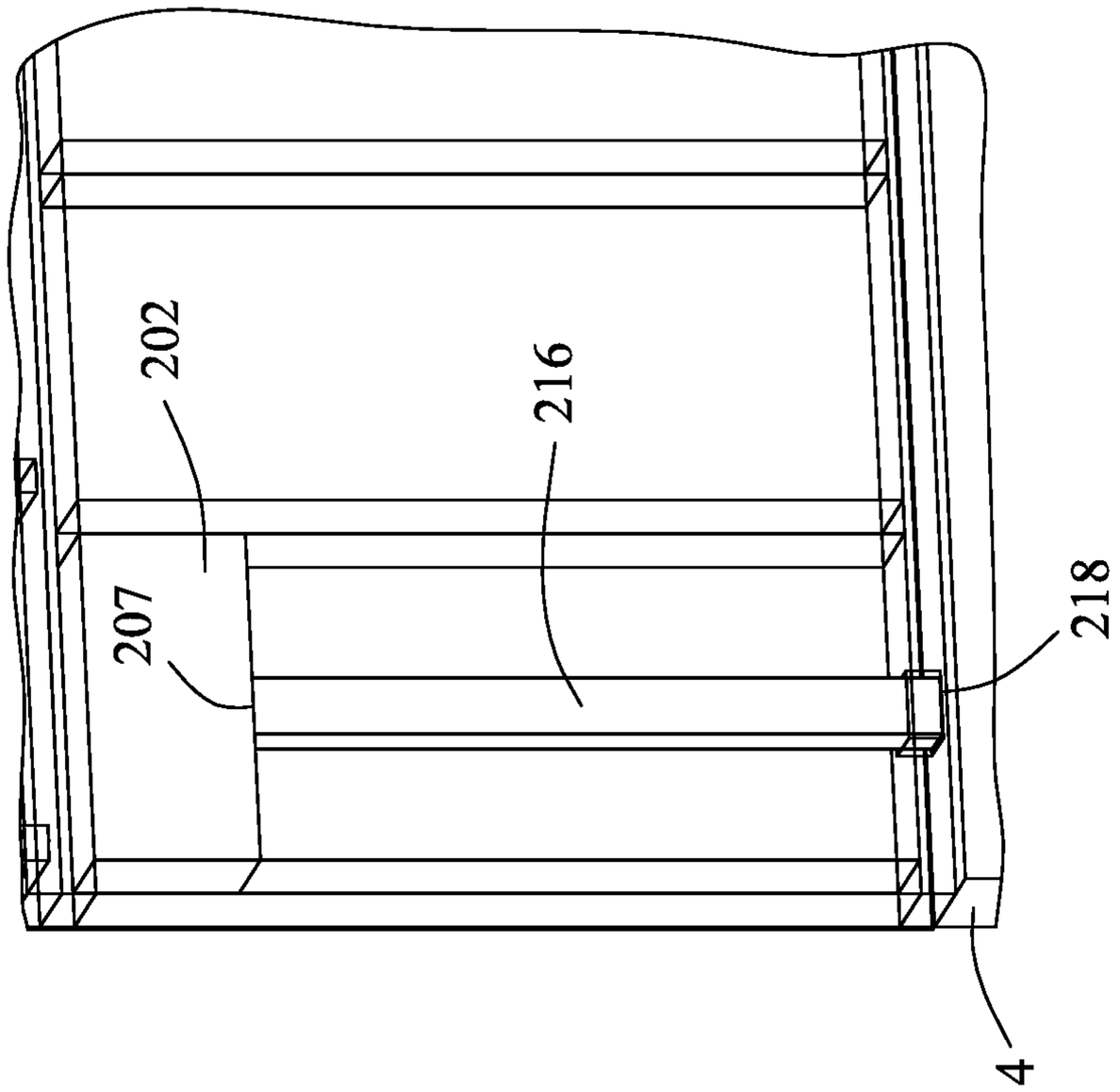


FIG. 123

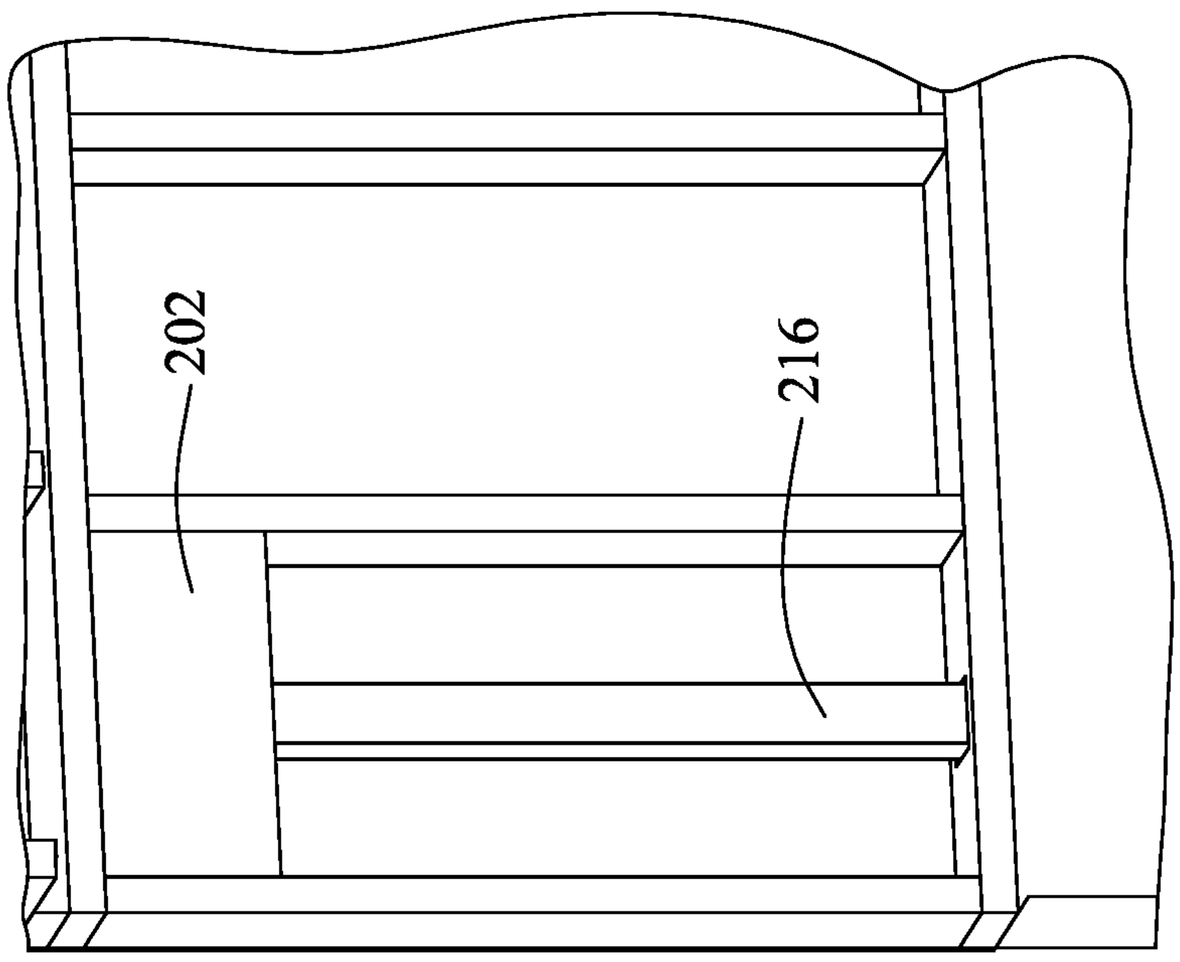


FIG. 122

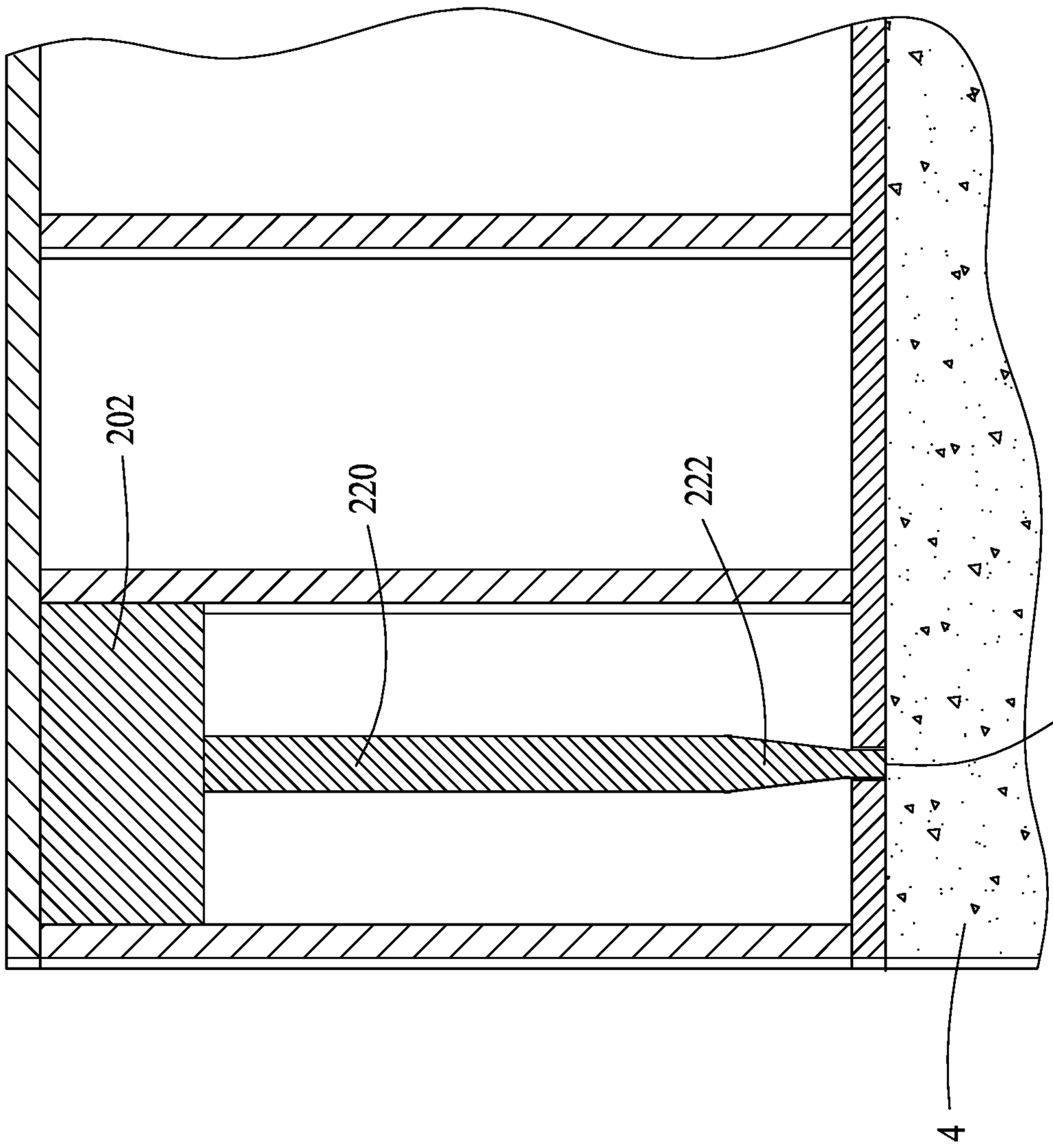


FIG. 124

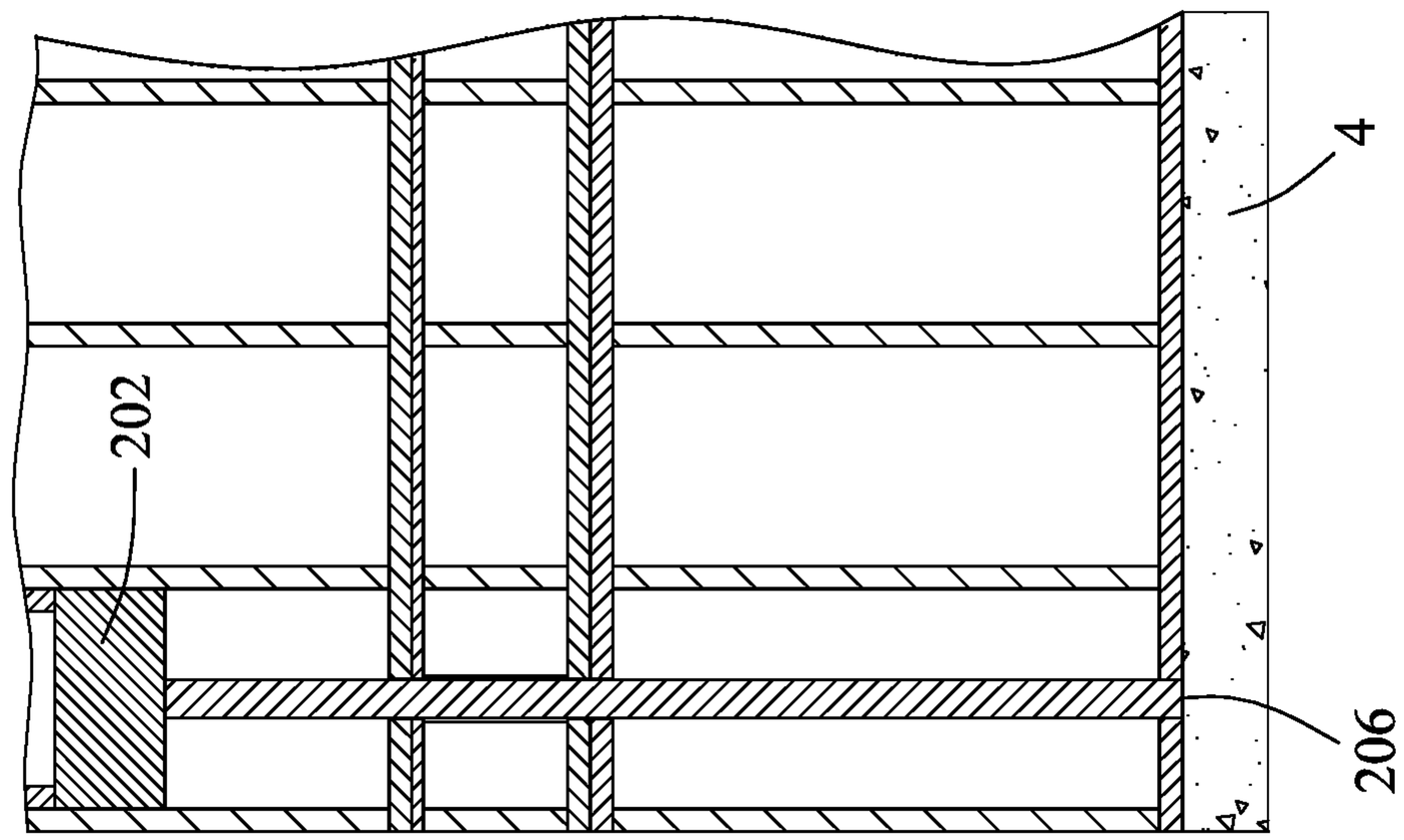


FIG. 126

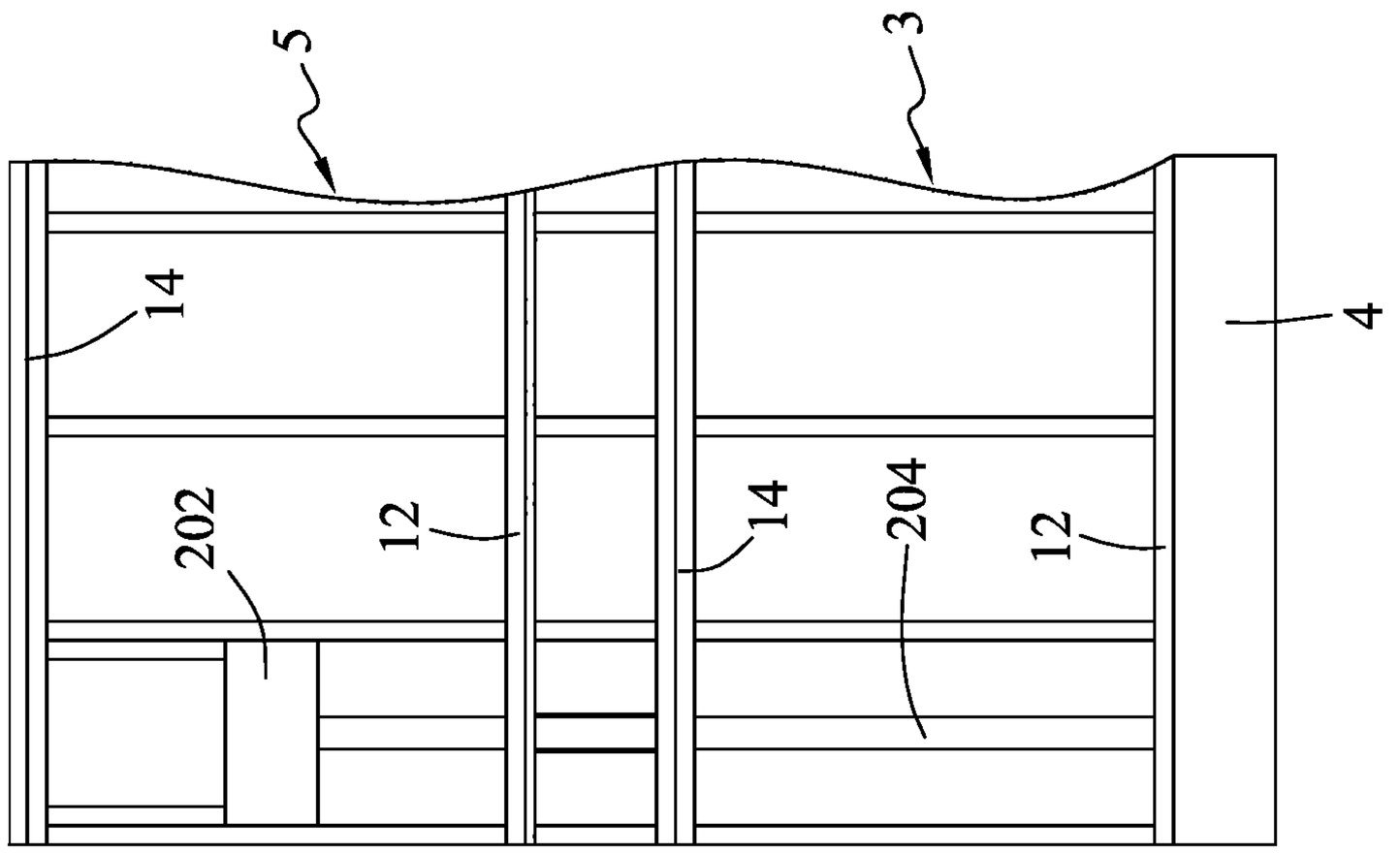
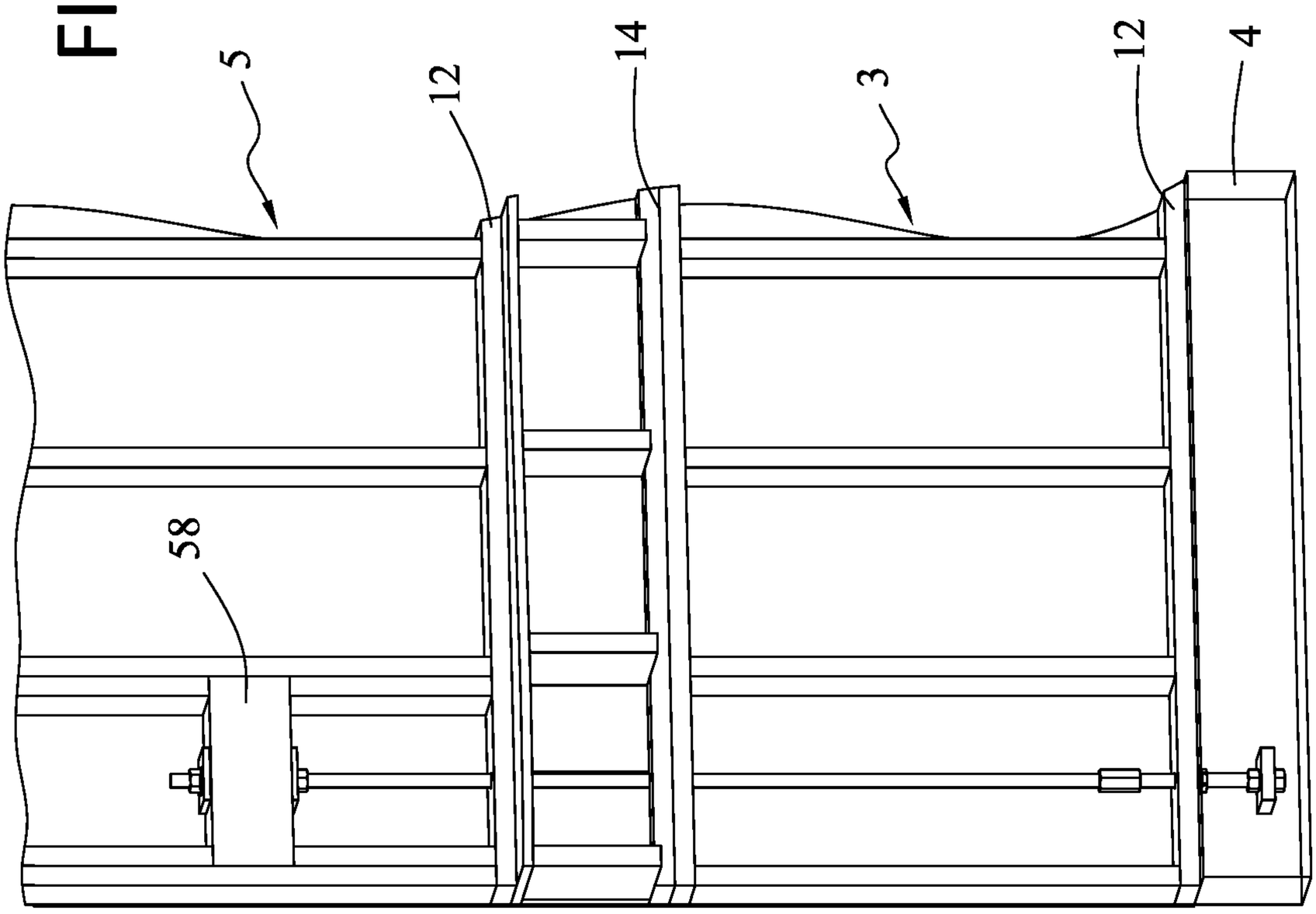


FIG. 125

FIG. 127



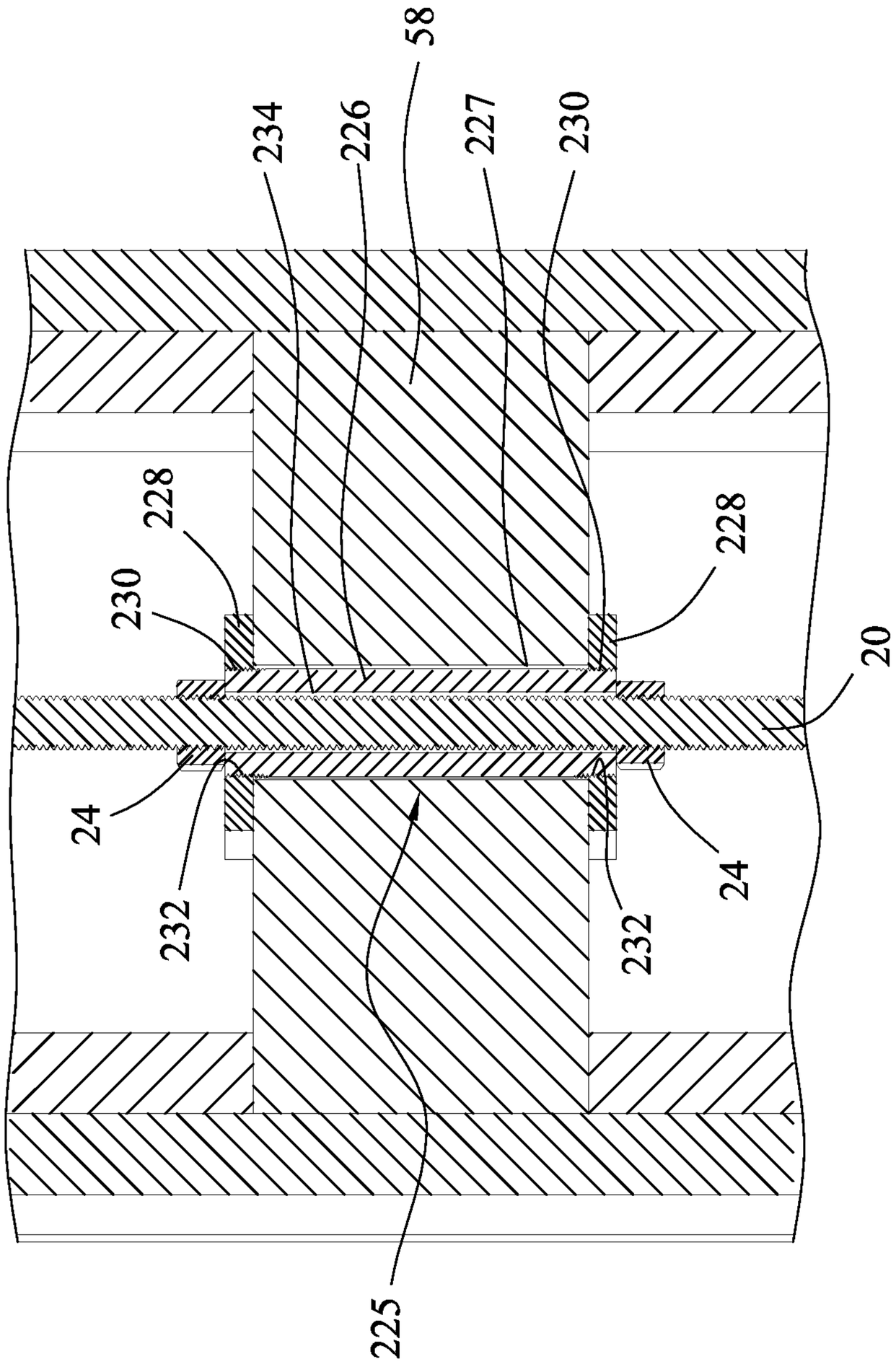


FIG. 128

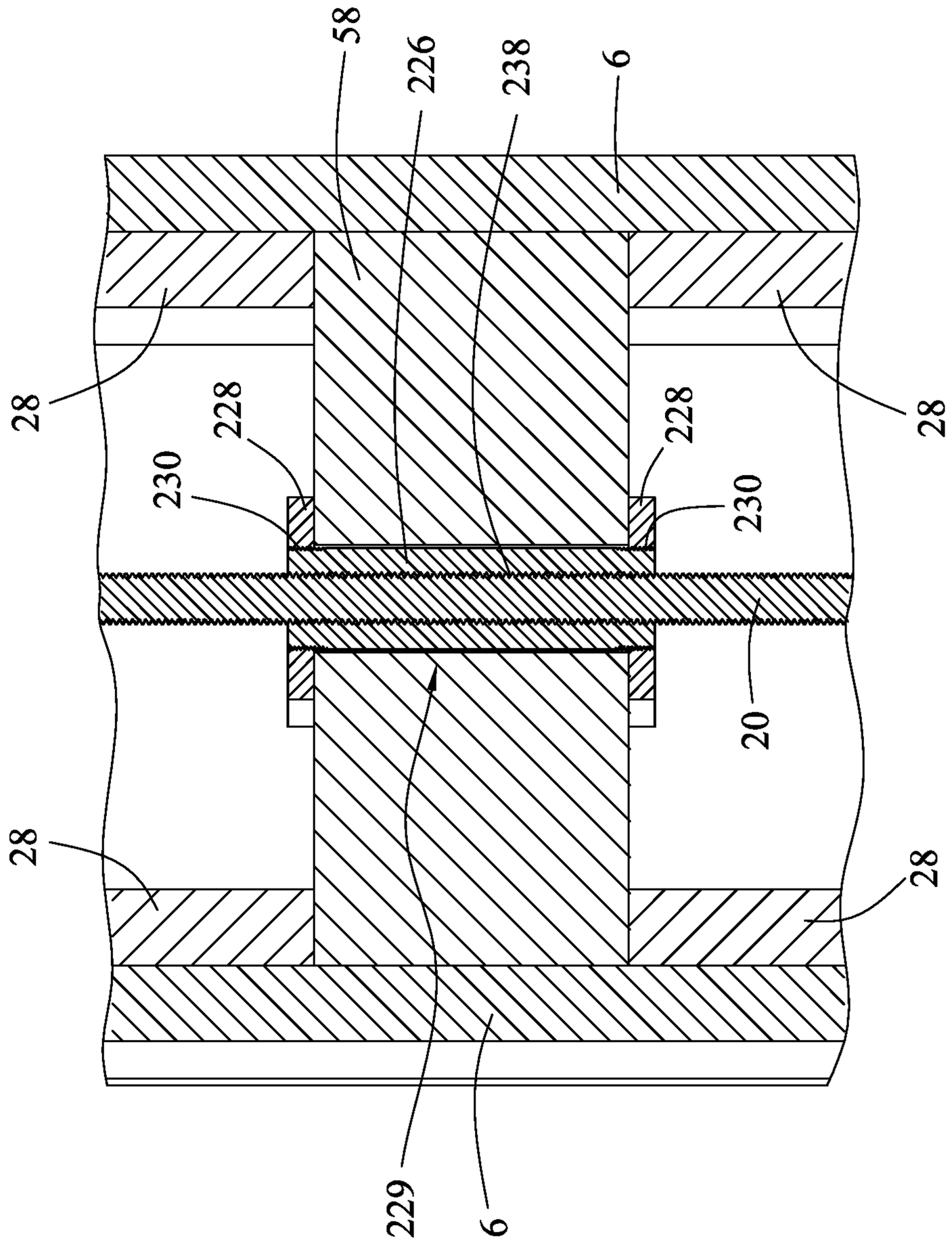


FIG. 129

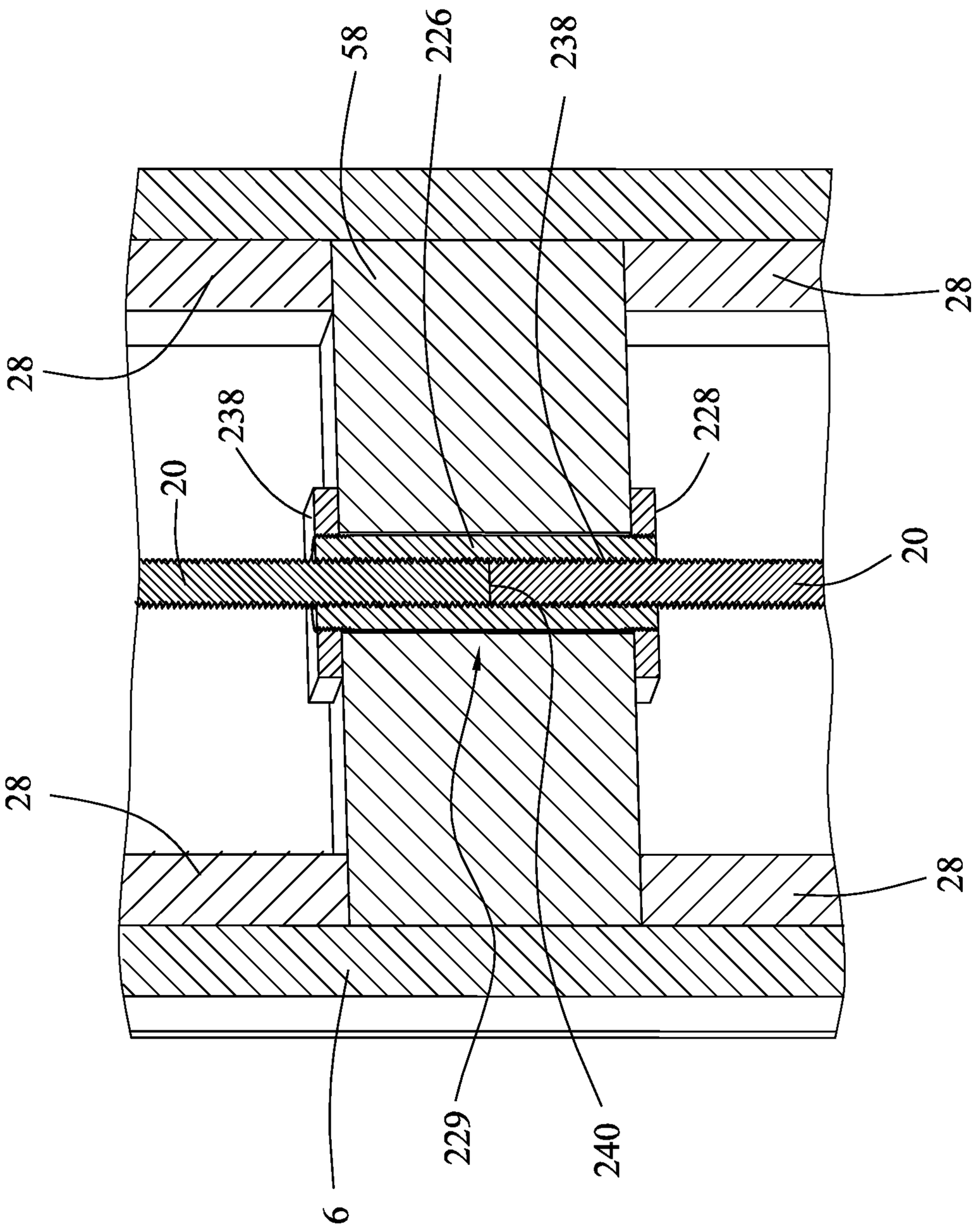


FIG. 130

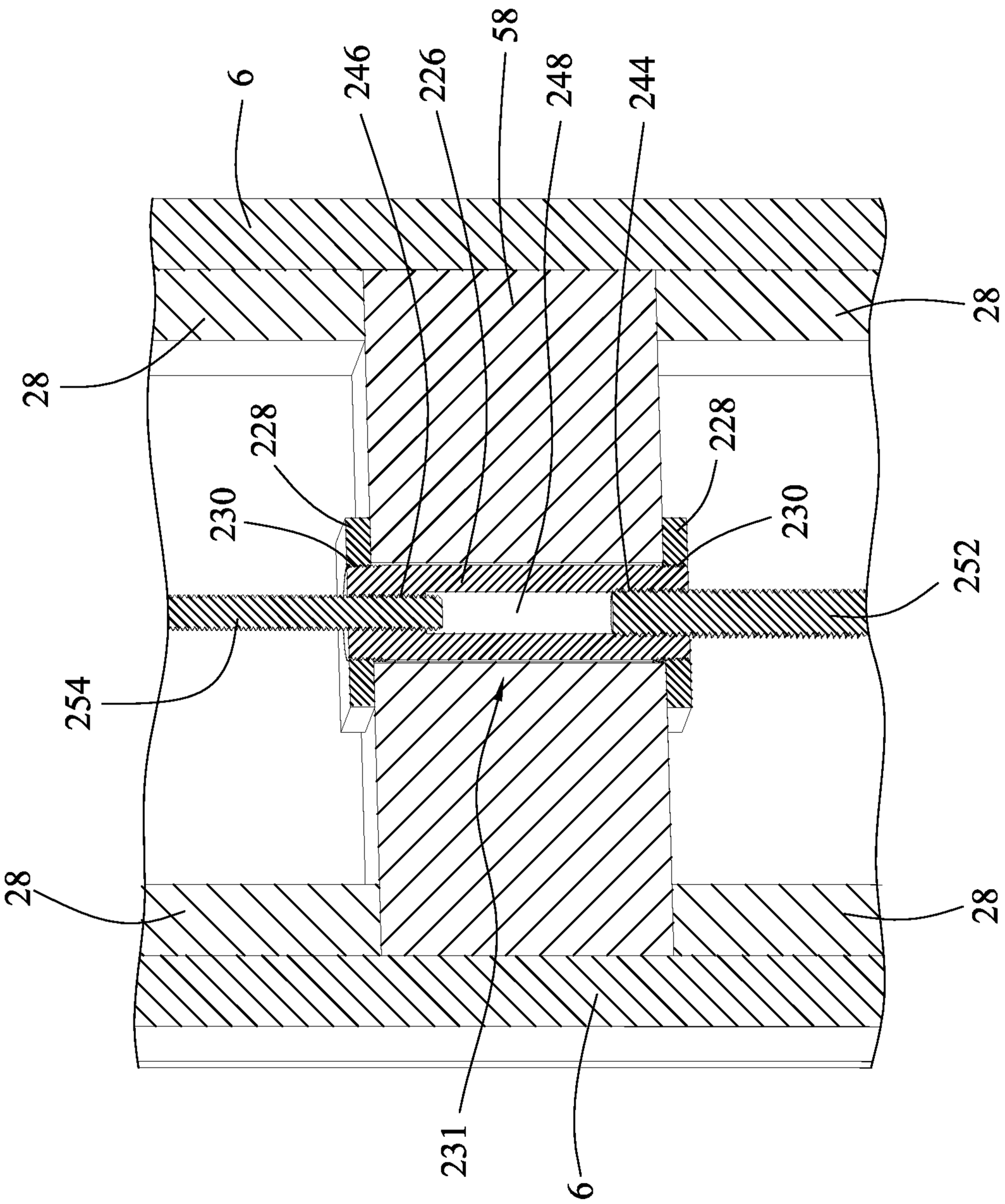


FIG. 131

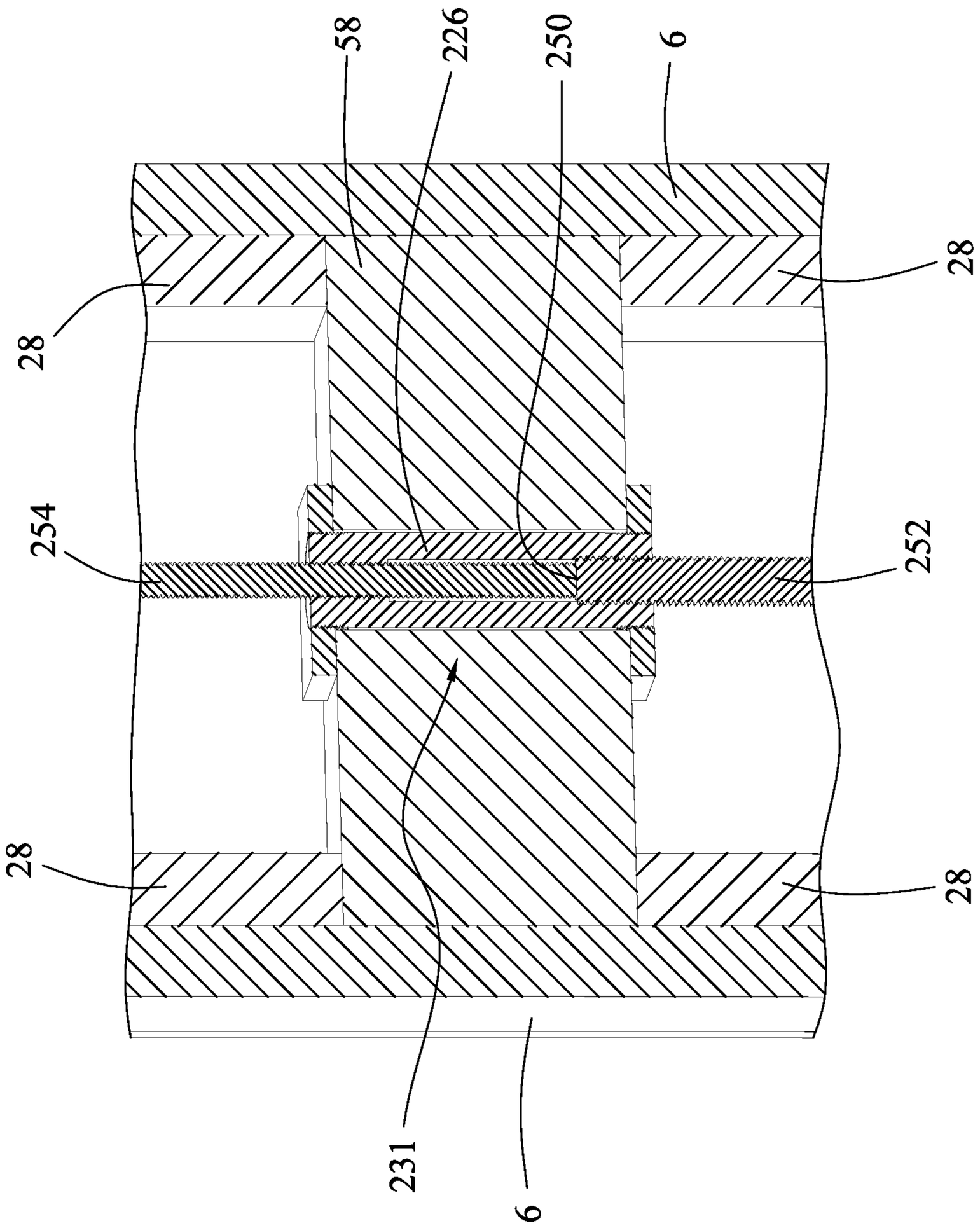


FIG. 132

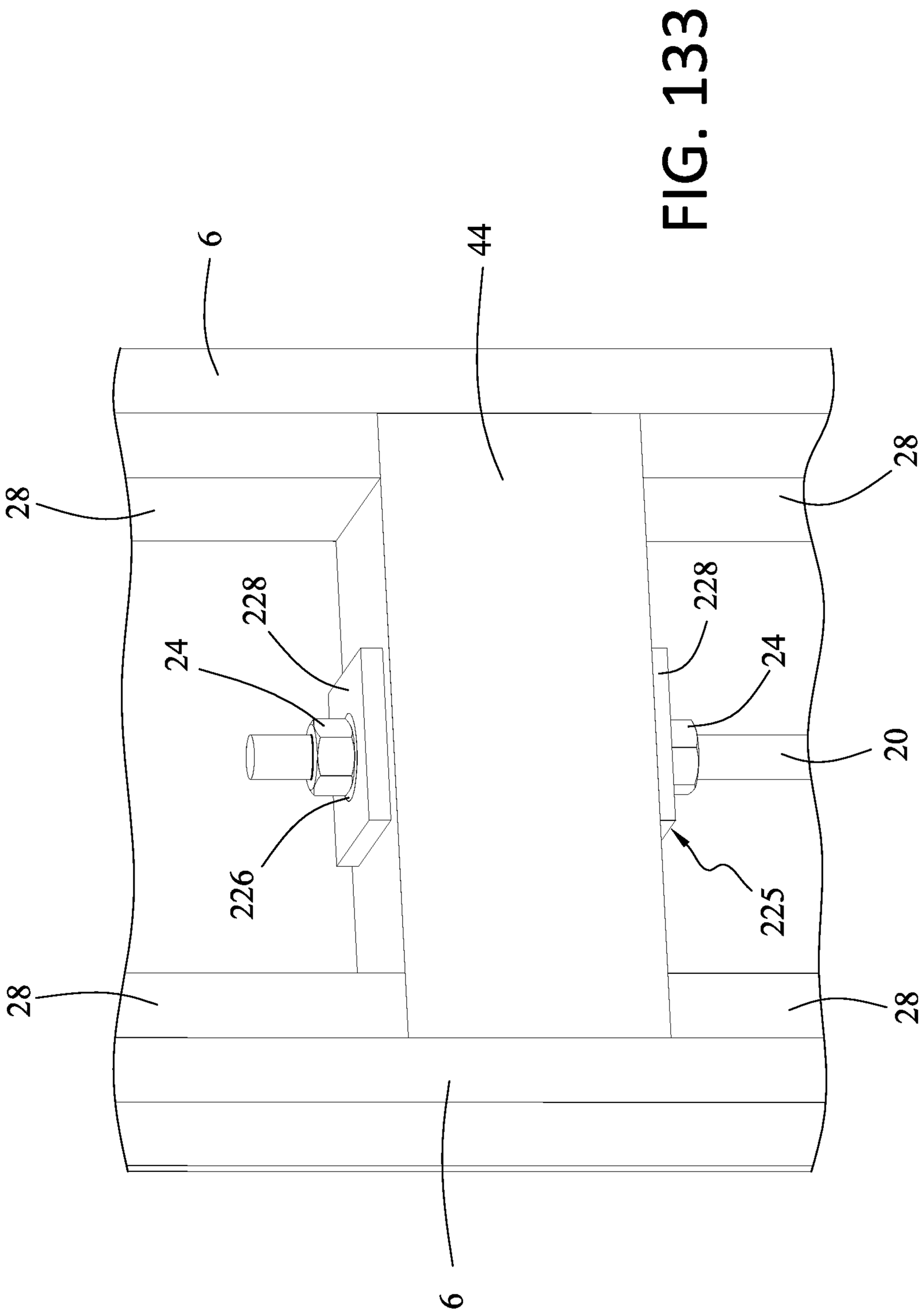


FIG. 133

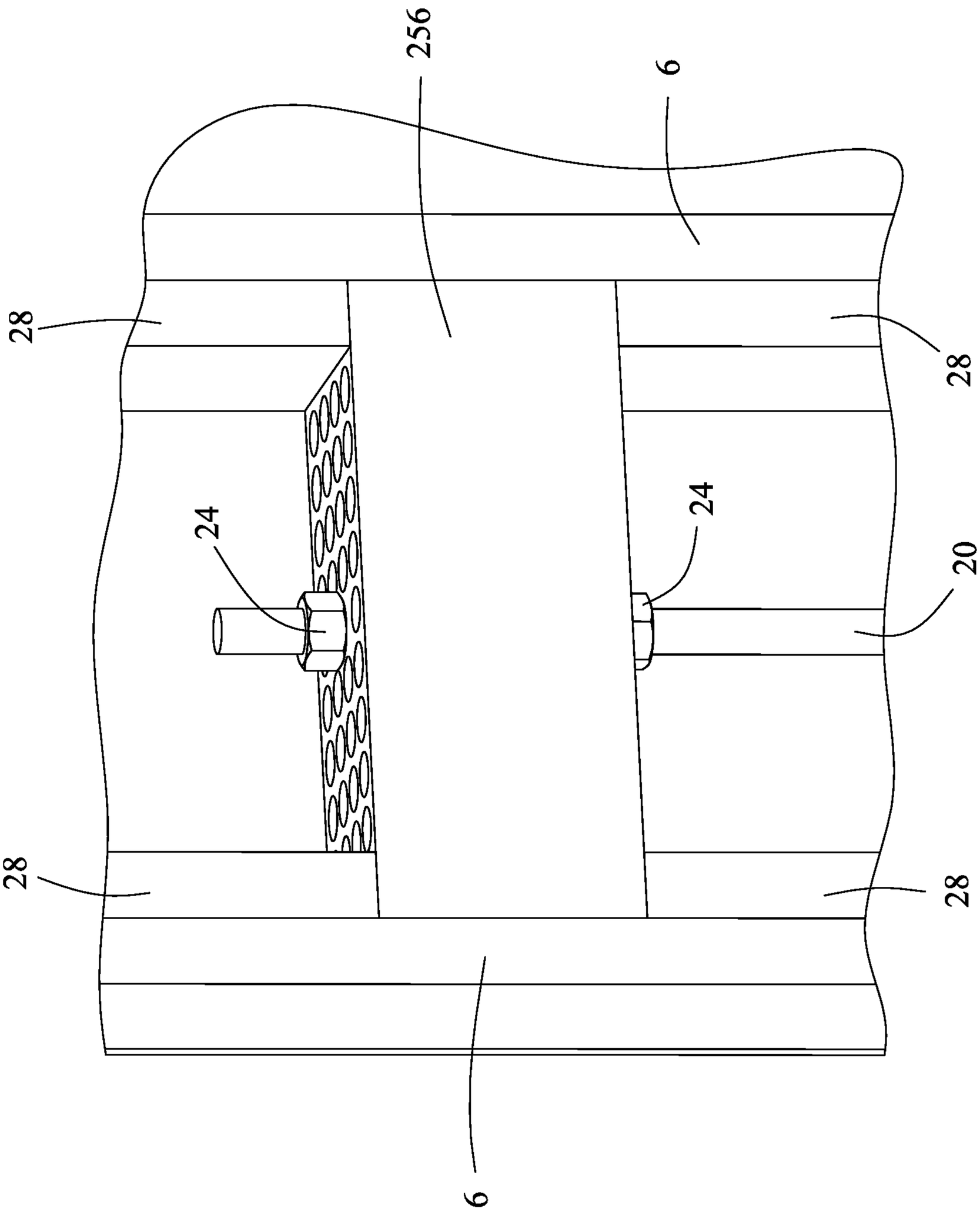


FIG. 134

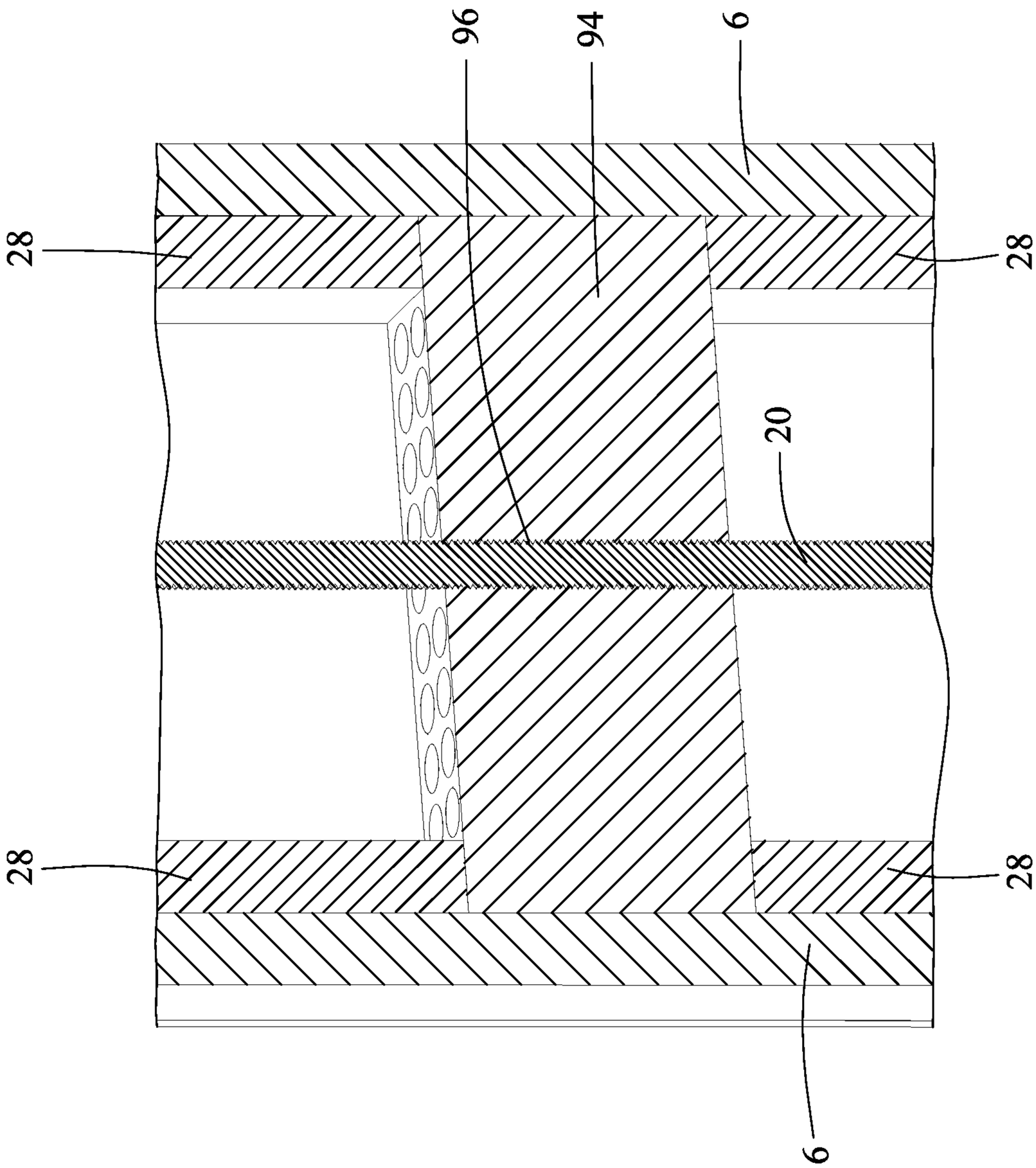


FIG. 135

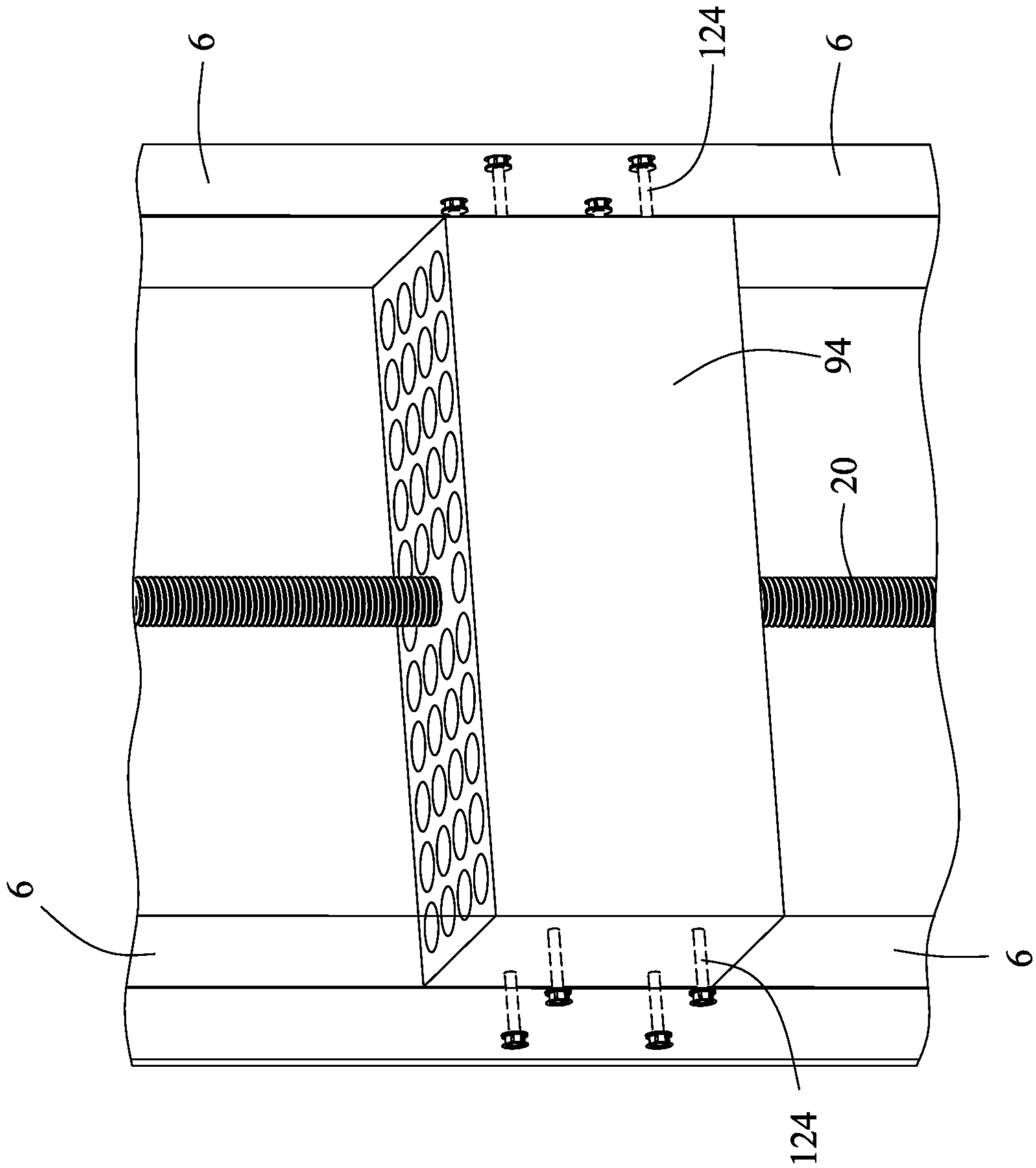


FIG. 136

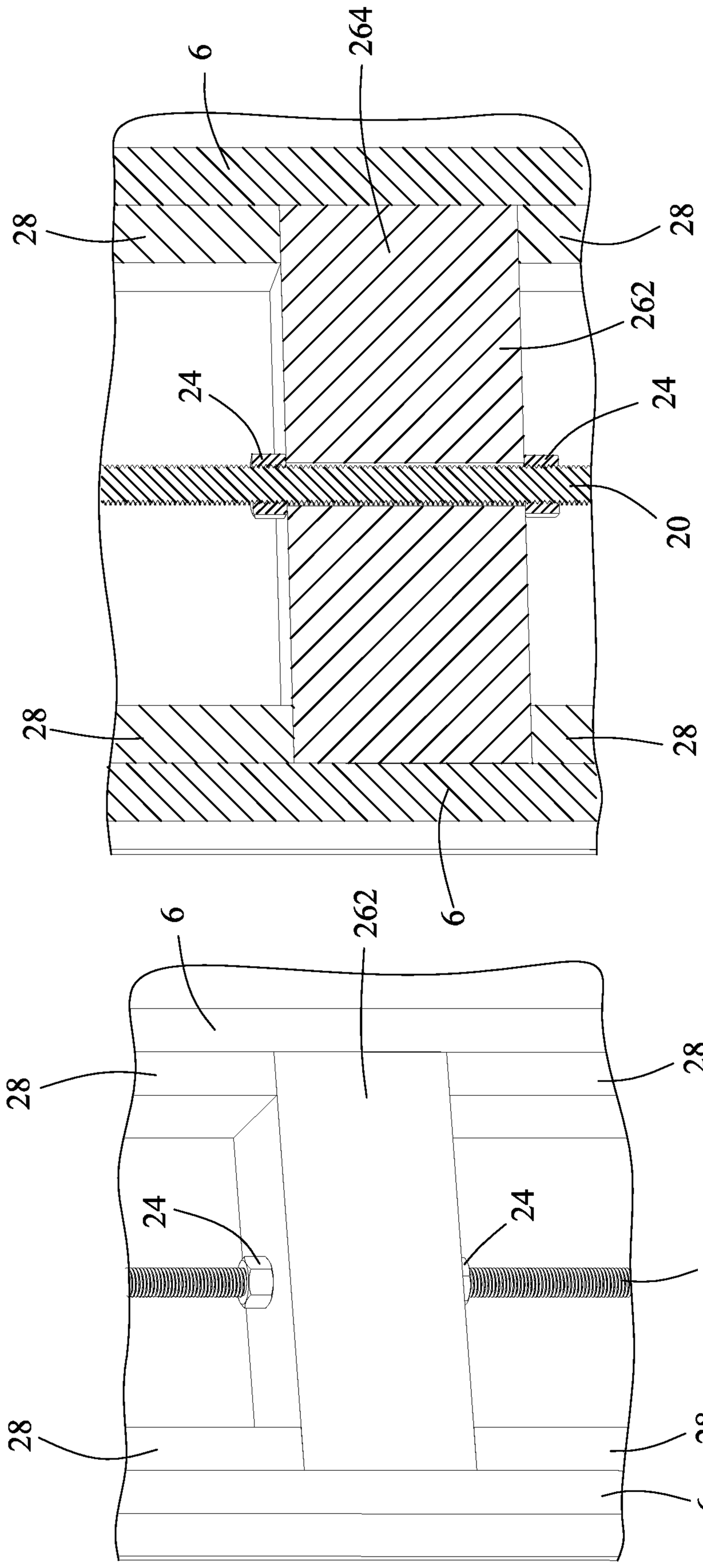


FIG. 138

FIG. 137

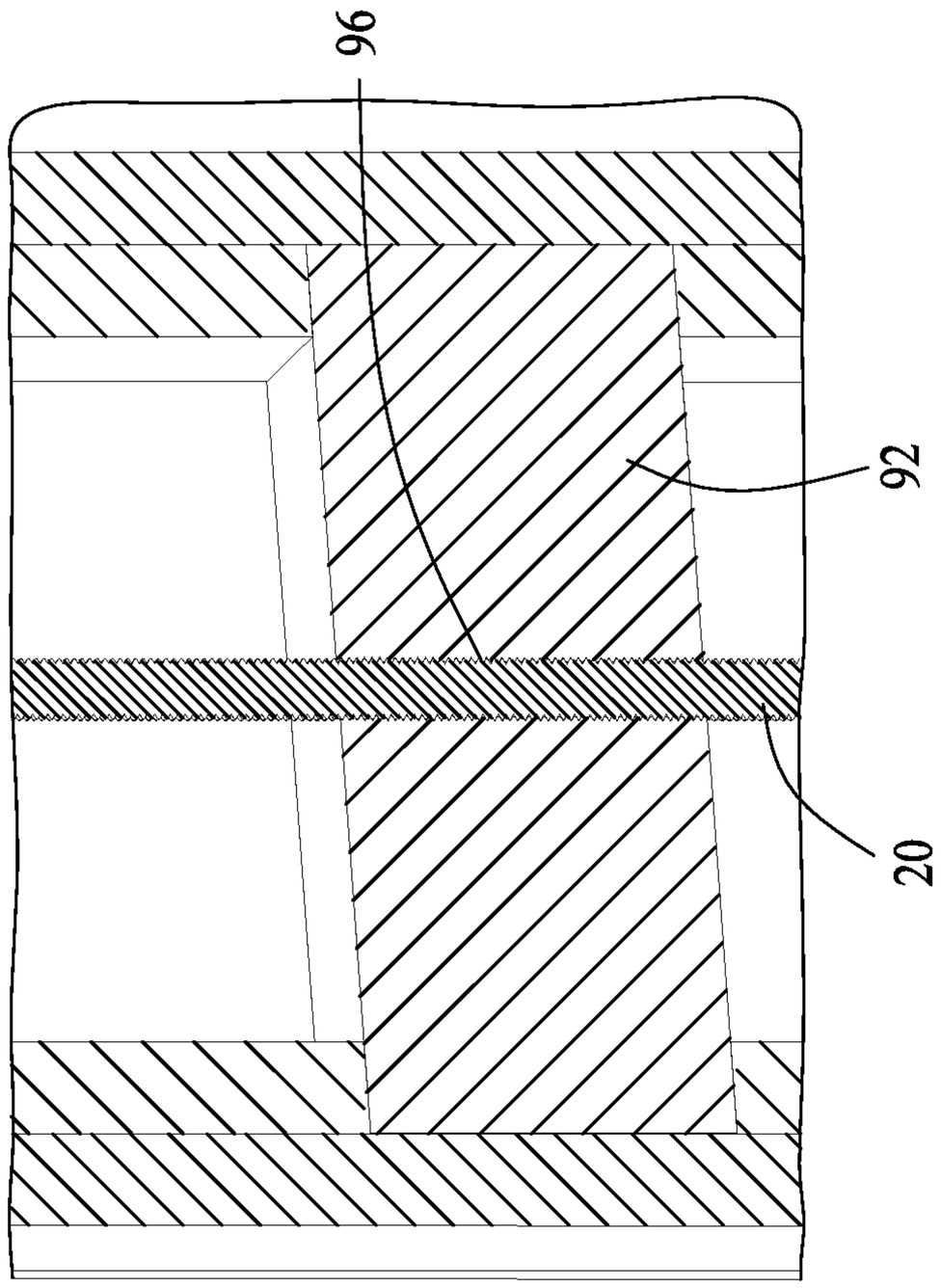


FIG. 140

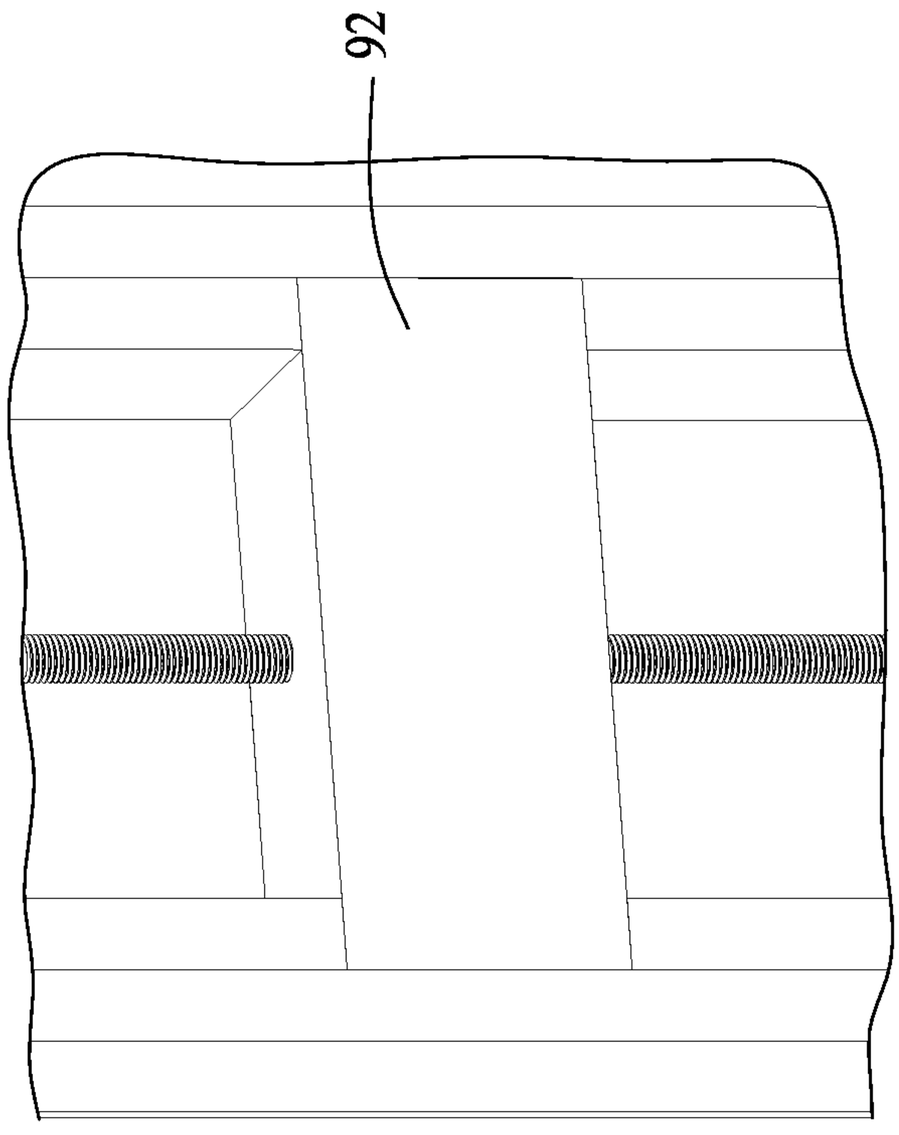


FIG. 139

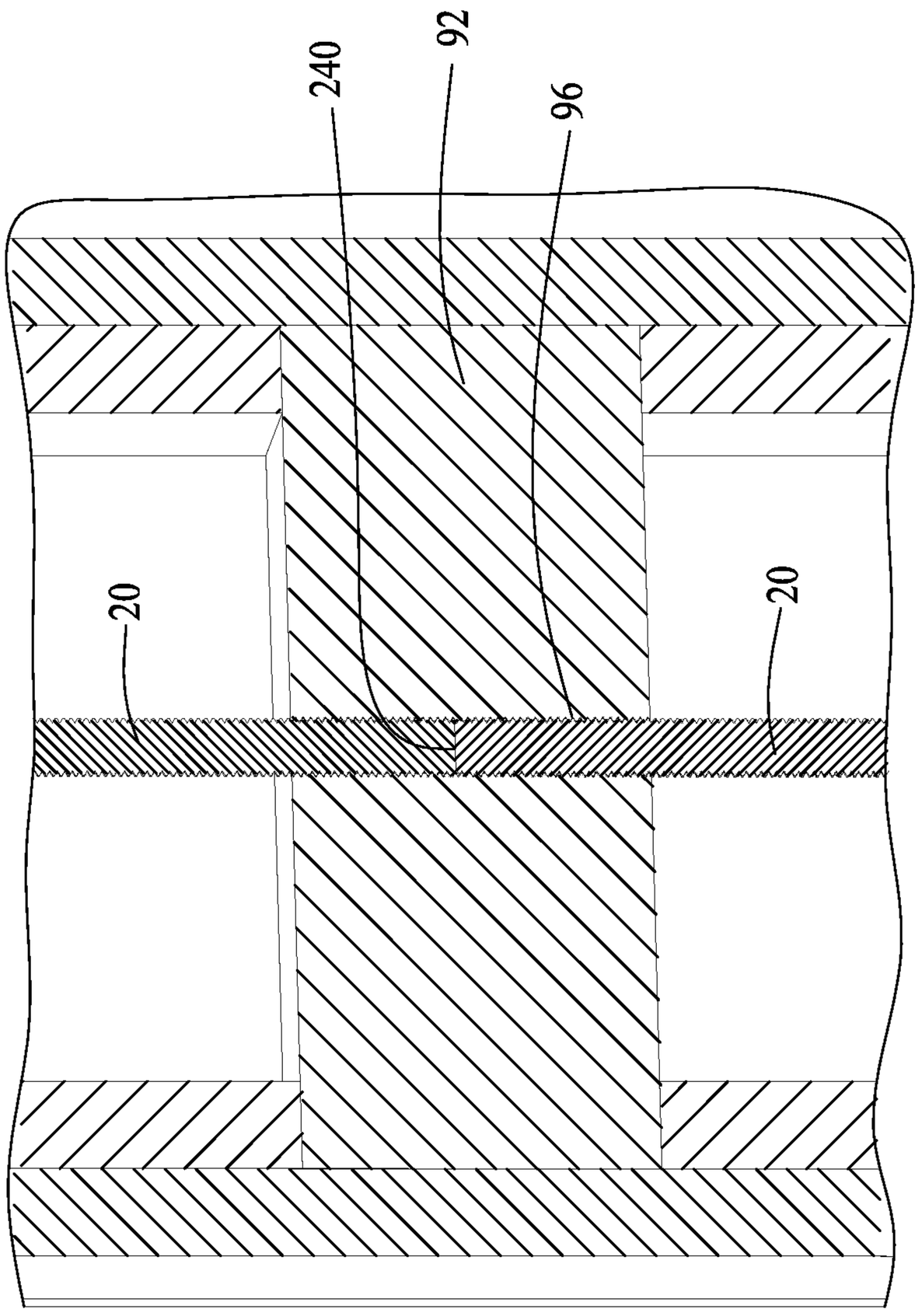


FIG. 141

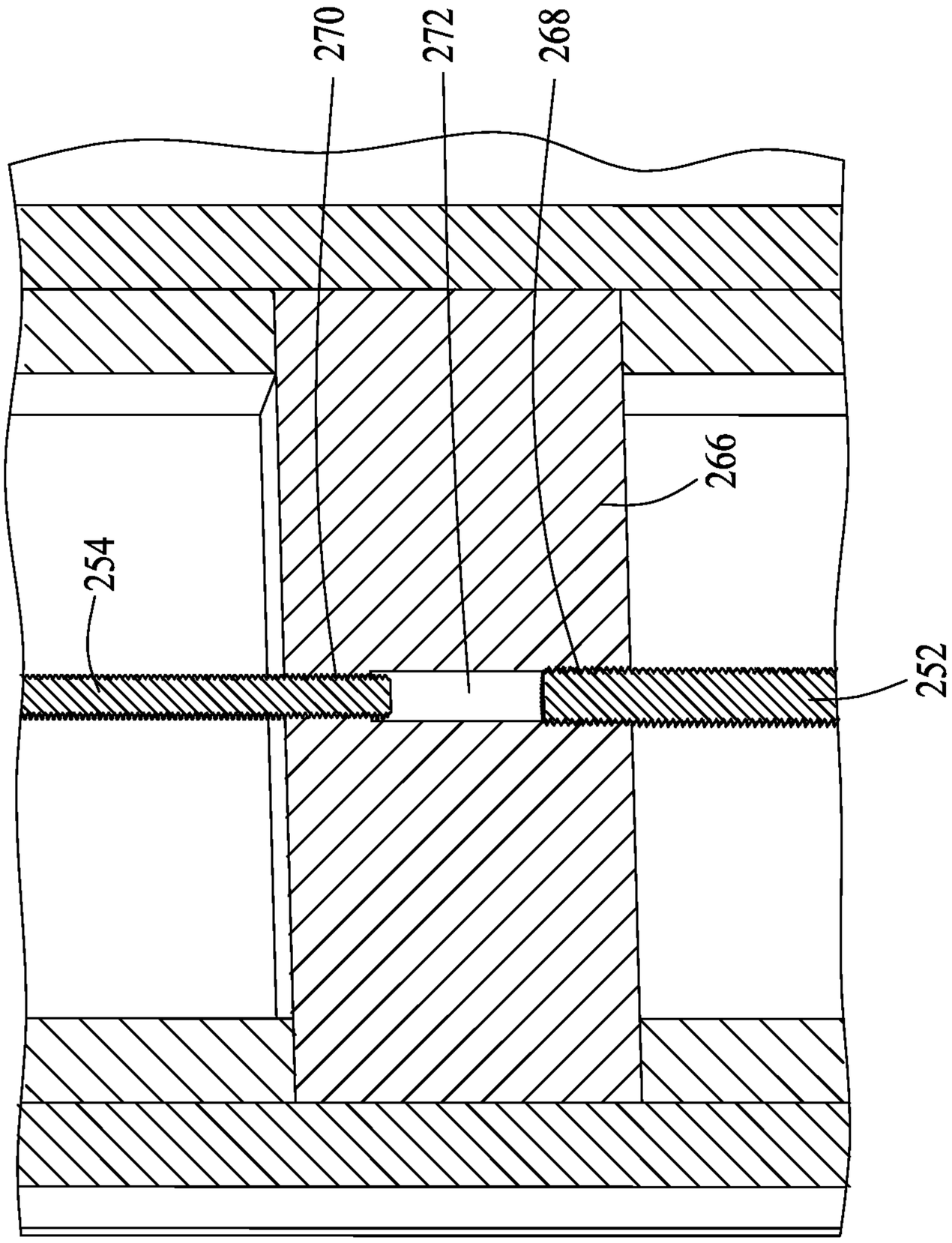
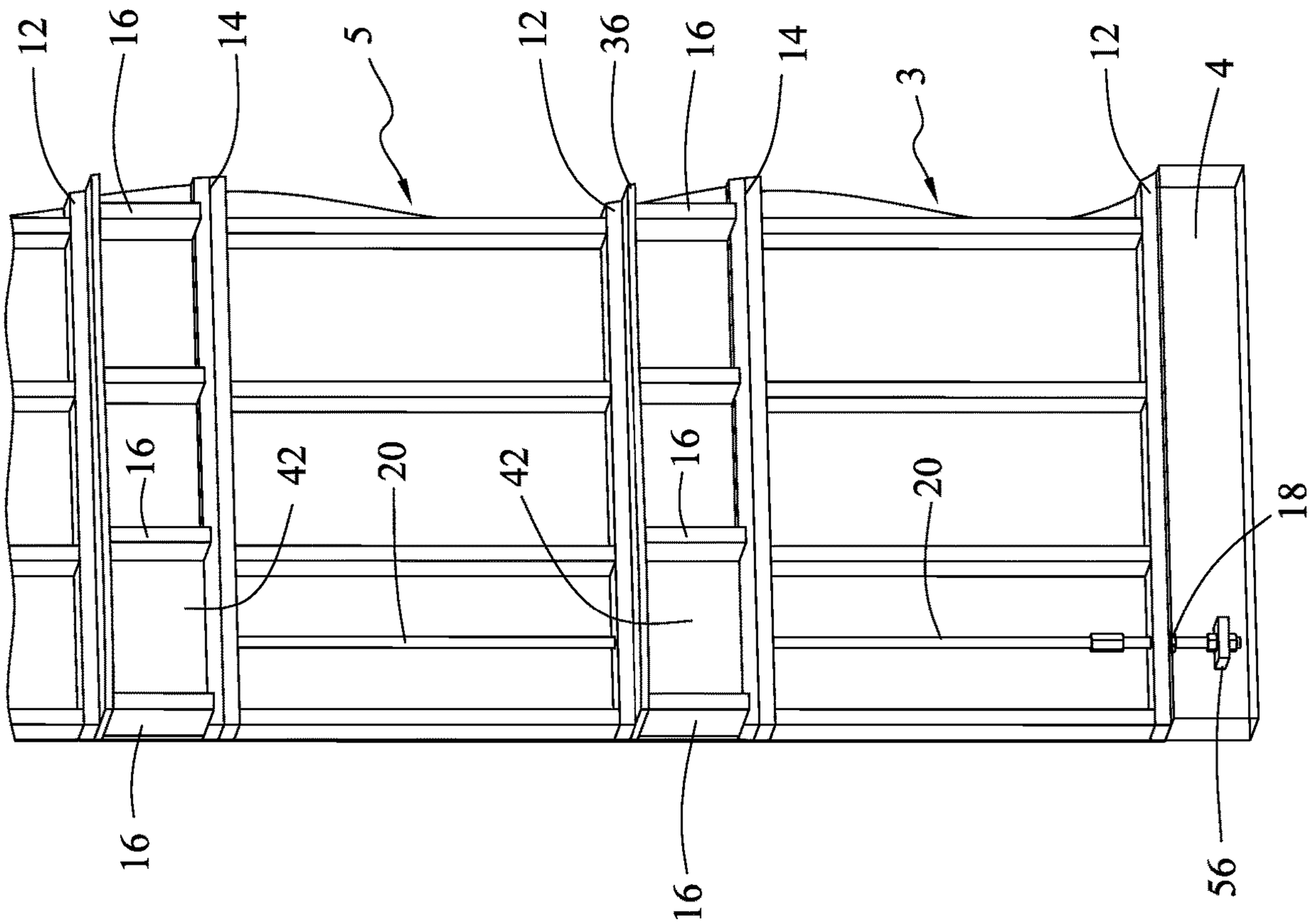


FIG. 142

FIG. 143



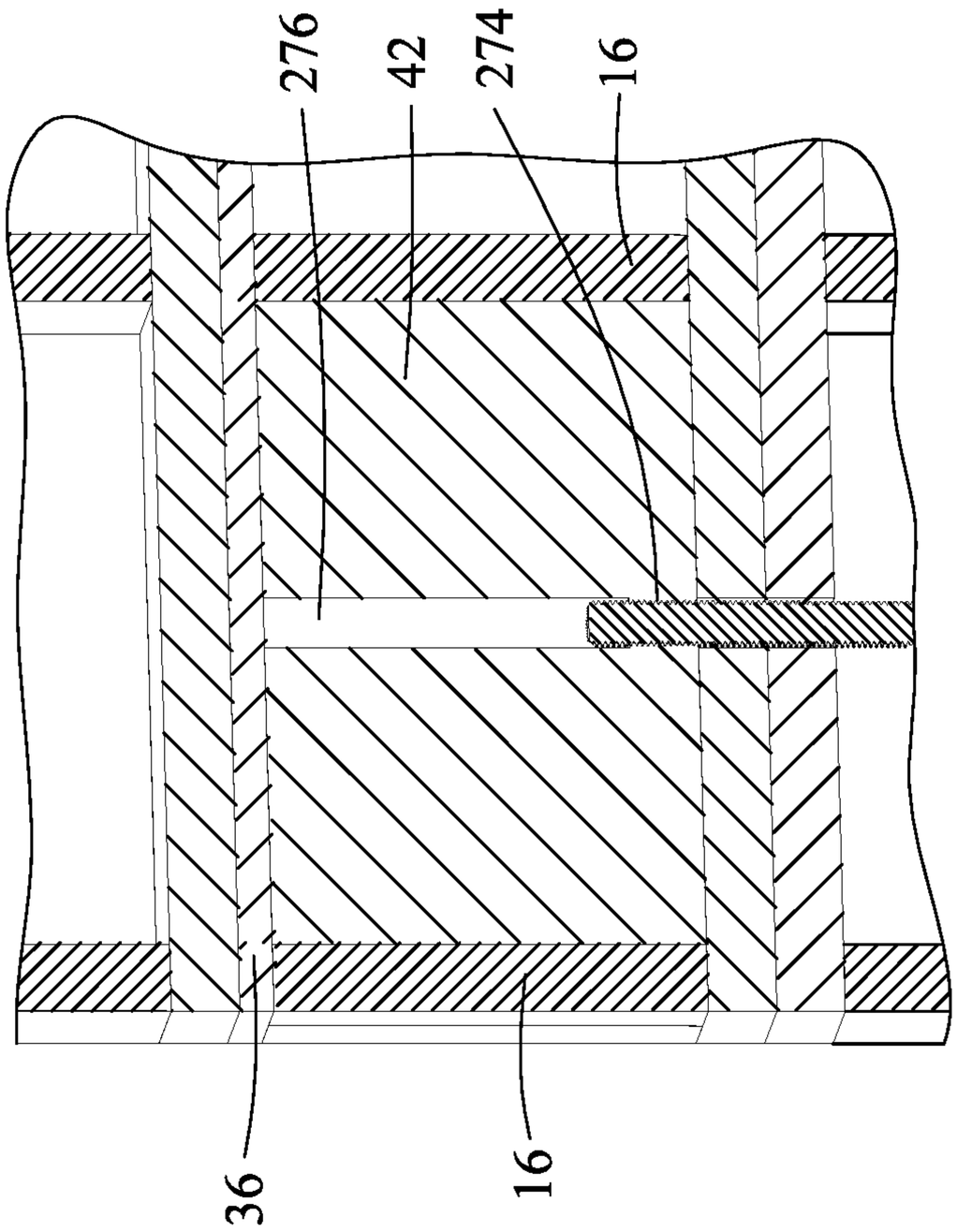


FIG. 145

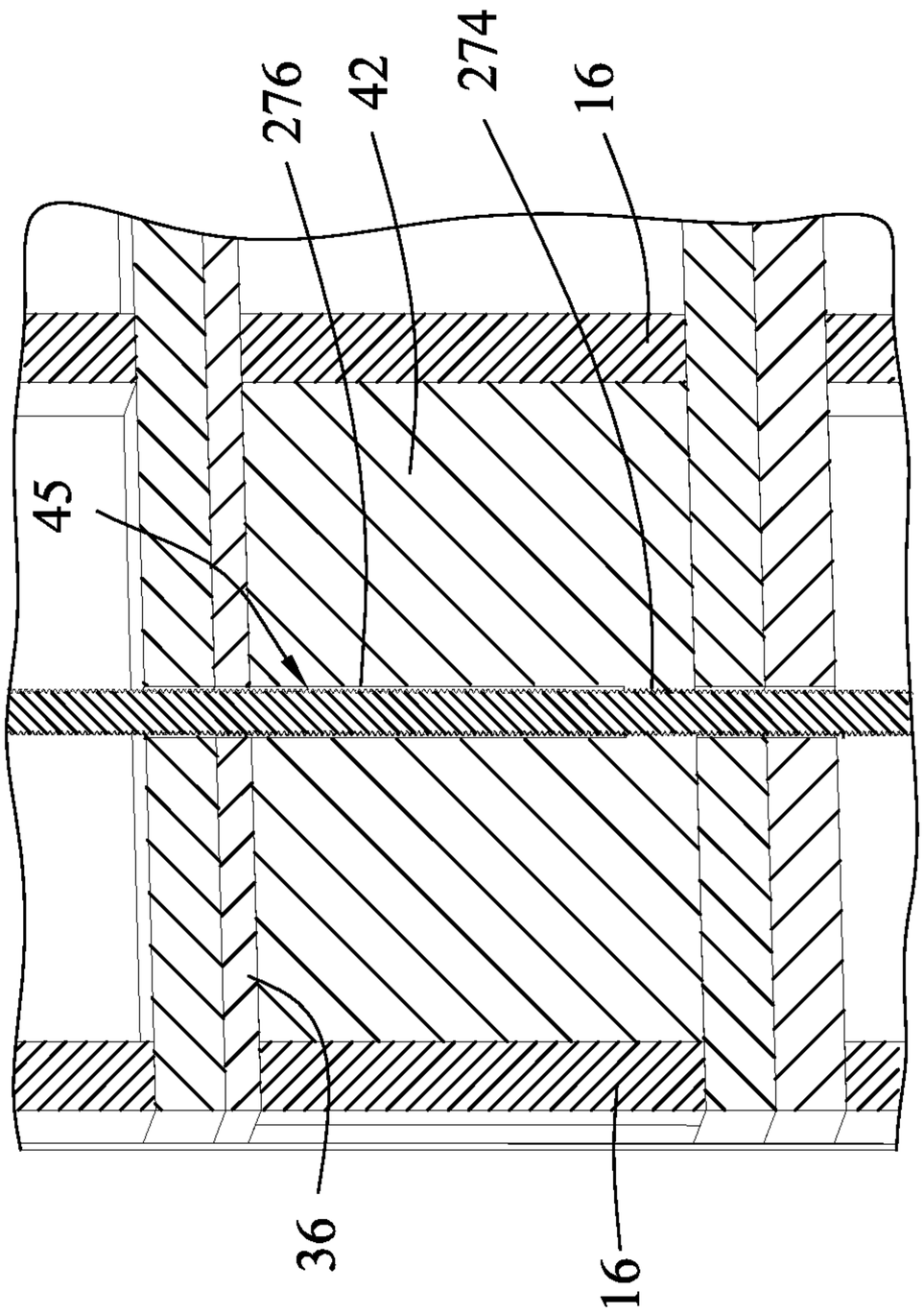
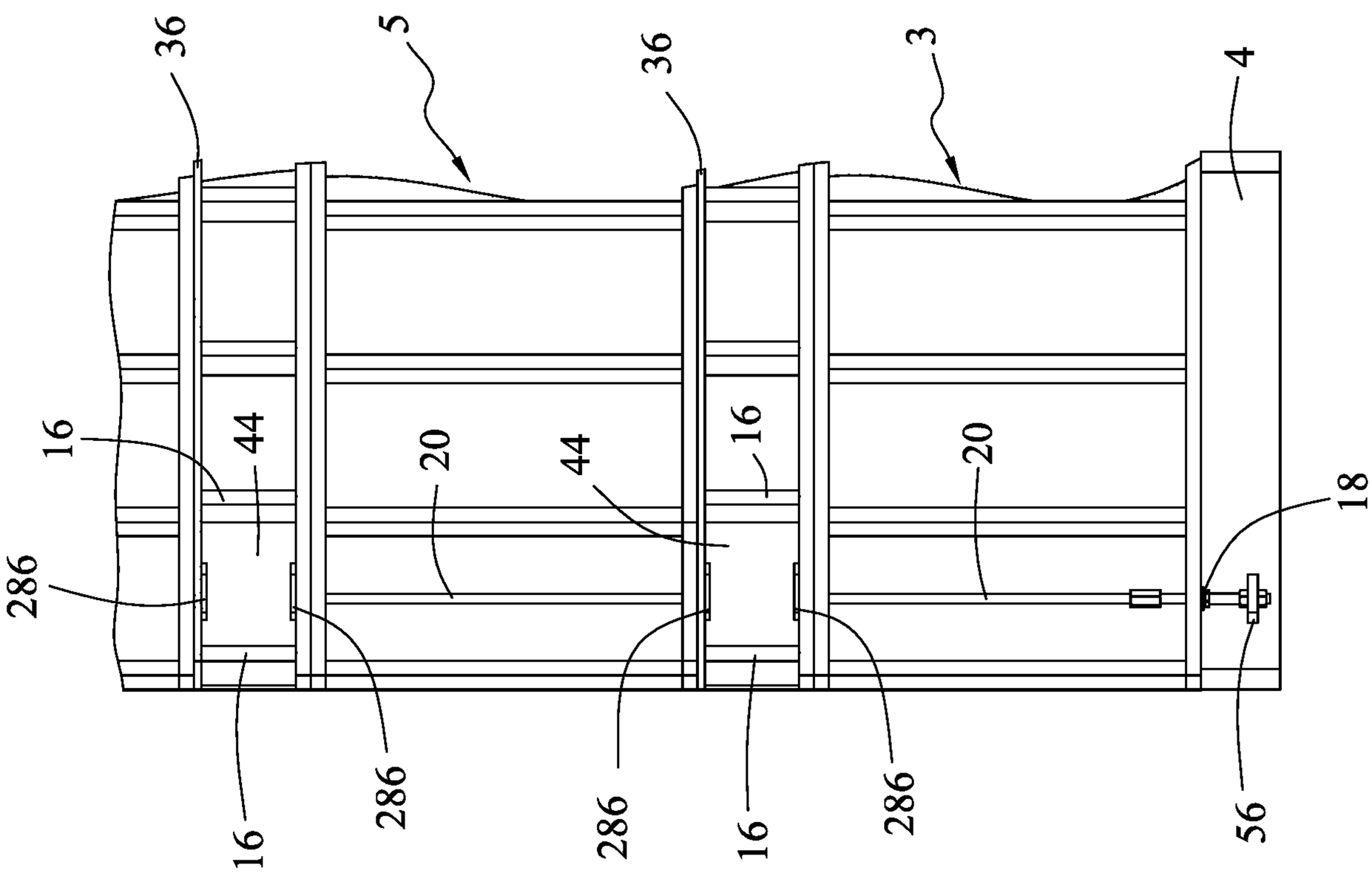


FIG. 144

FIG. 146



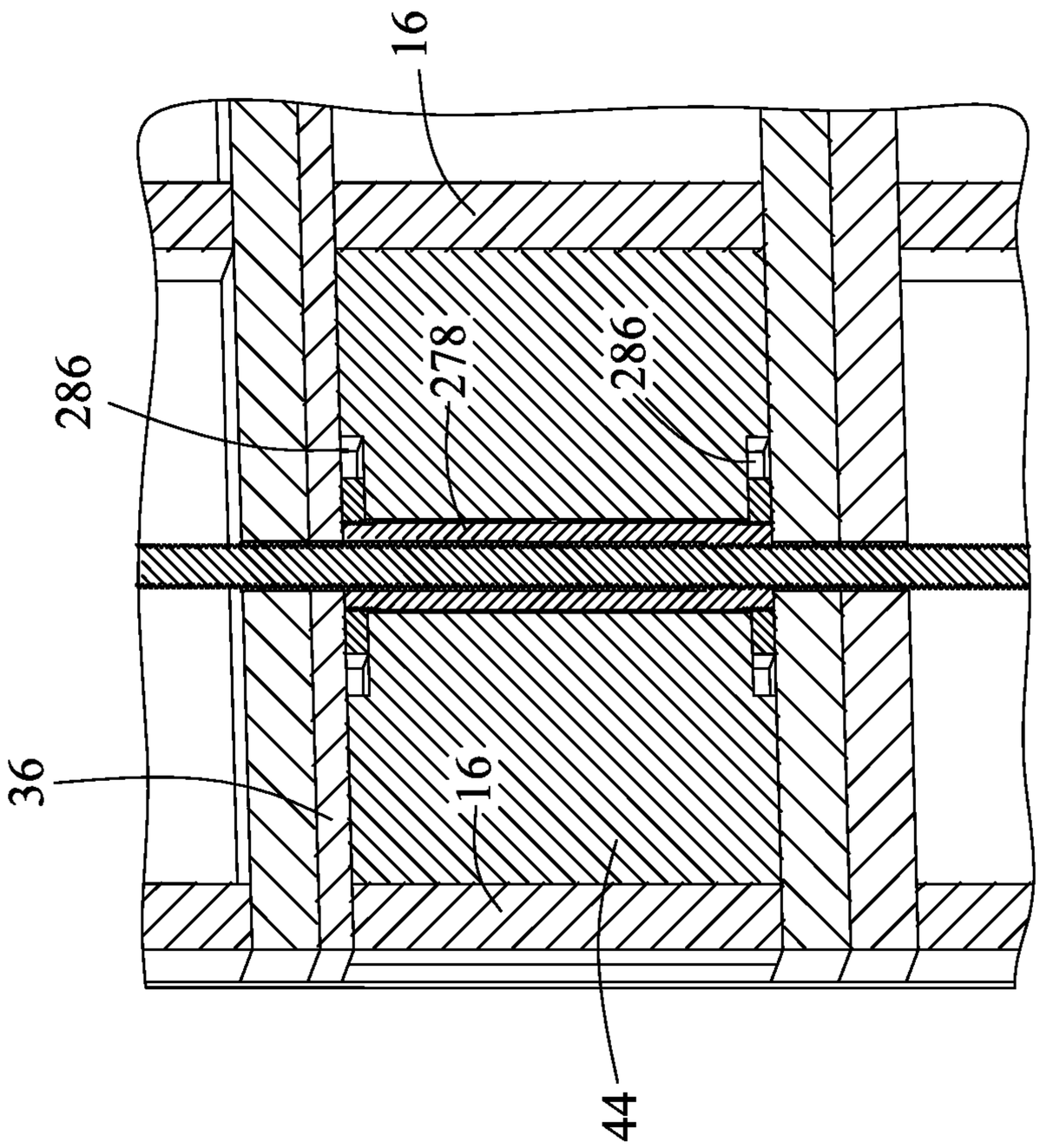


FIG. 148

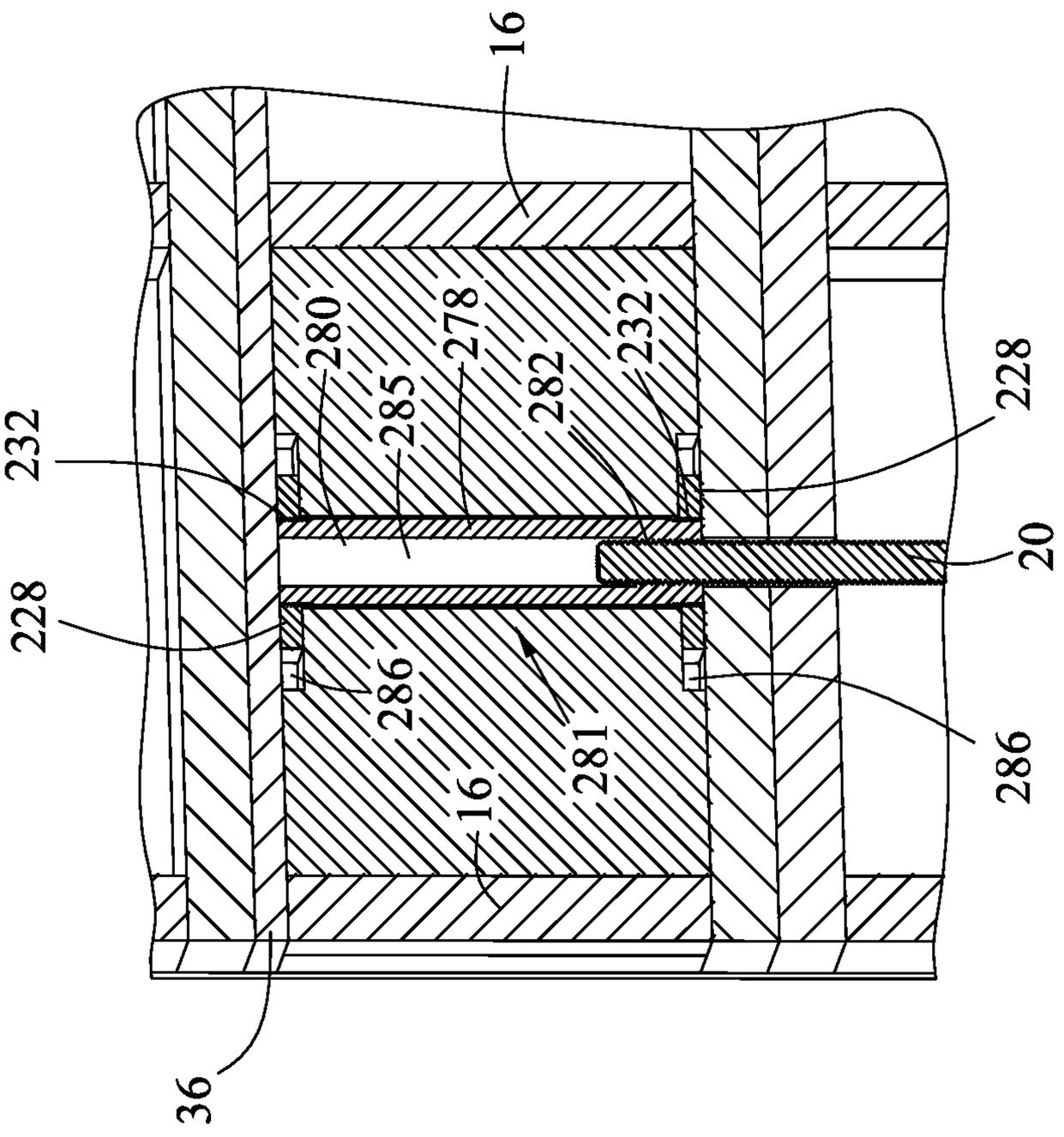
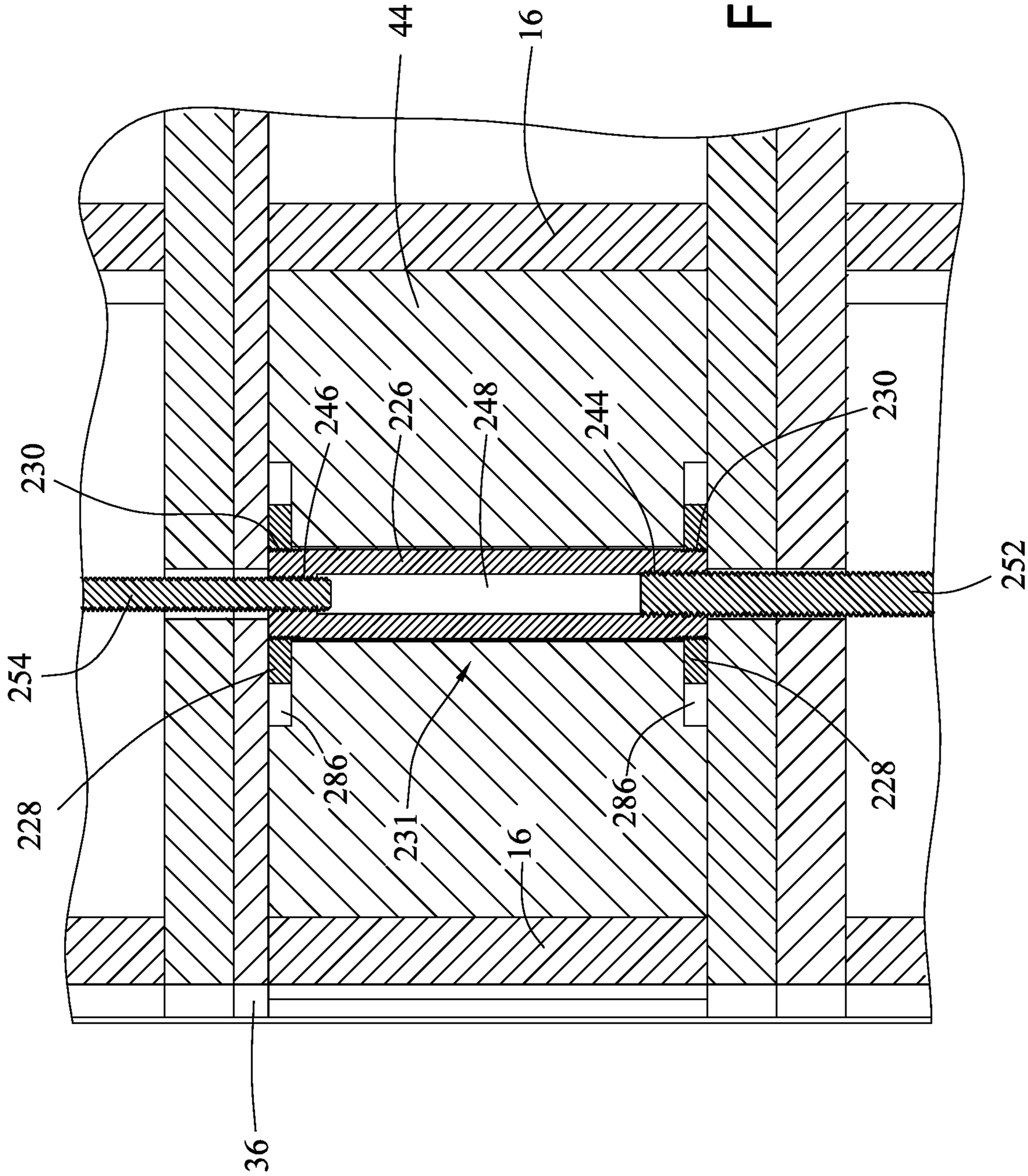


FIG. 147

FIG. 149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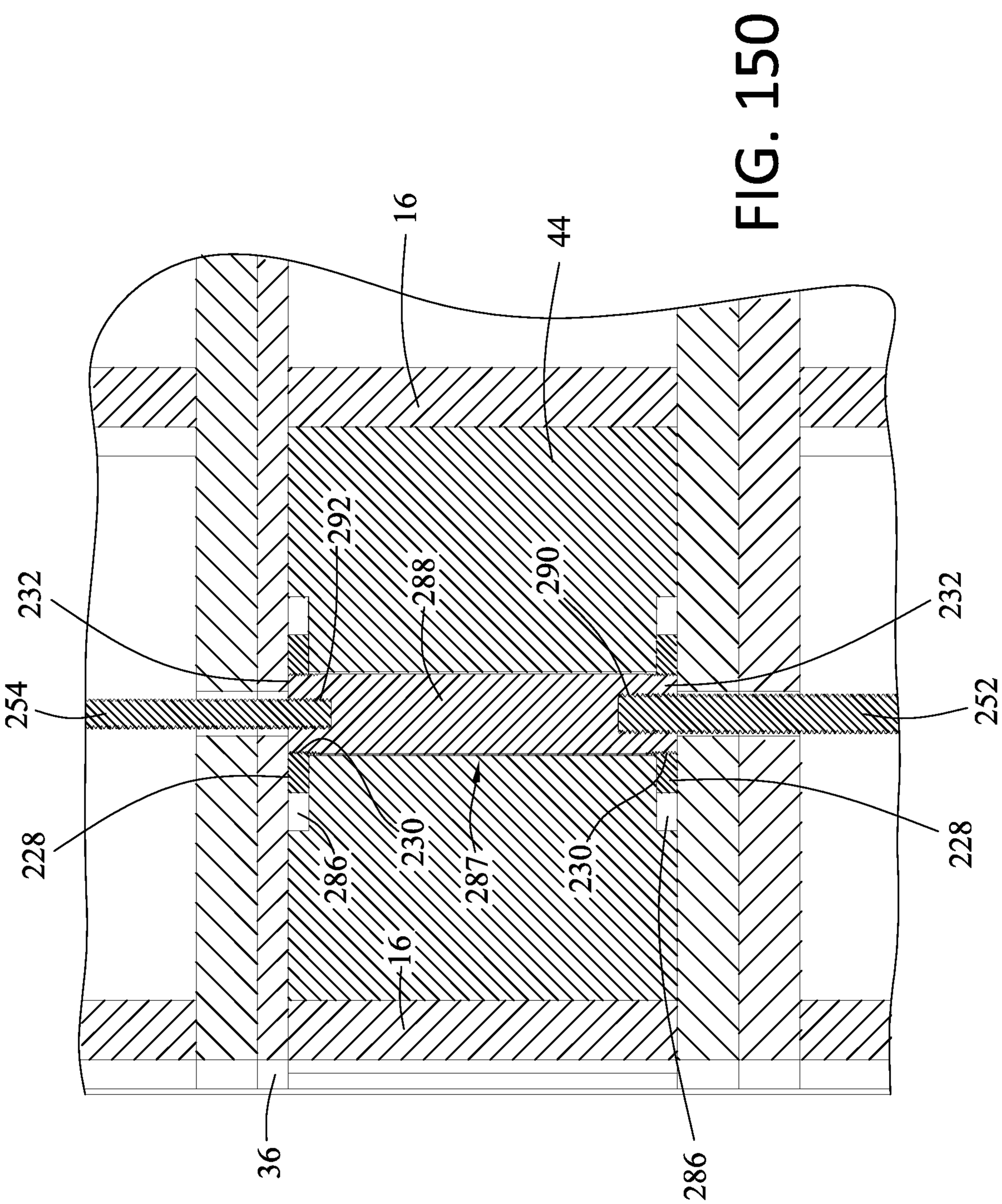
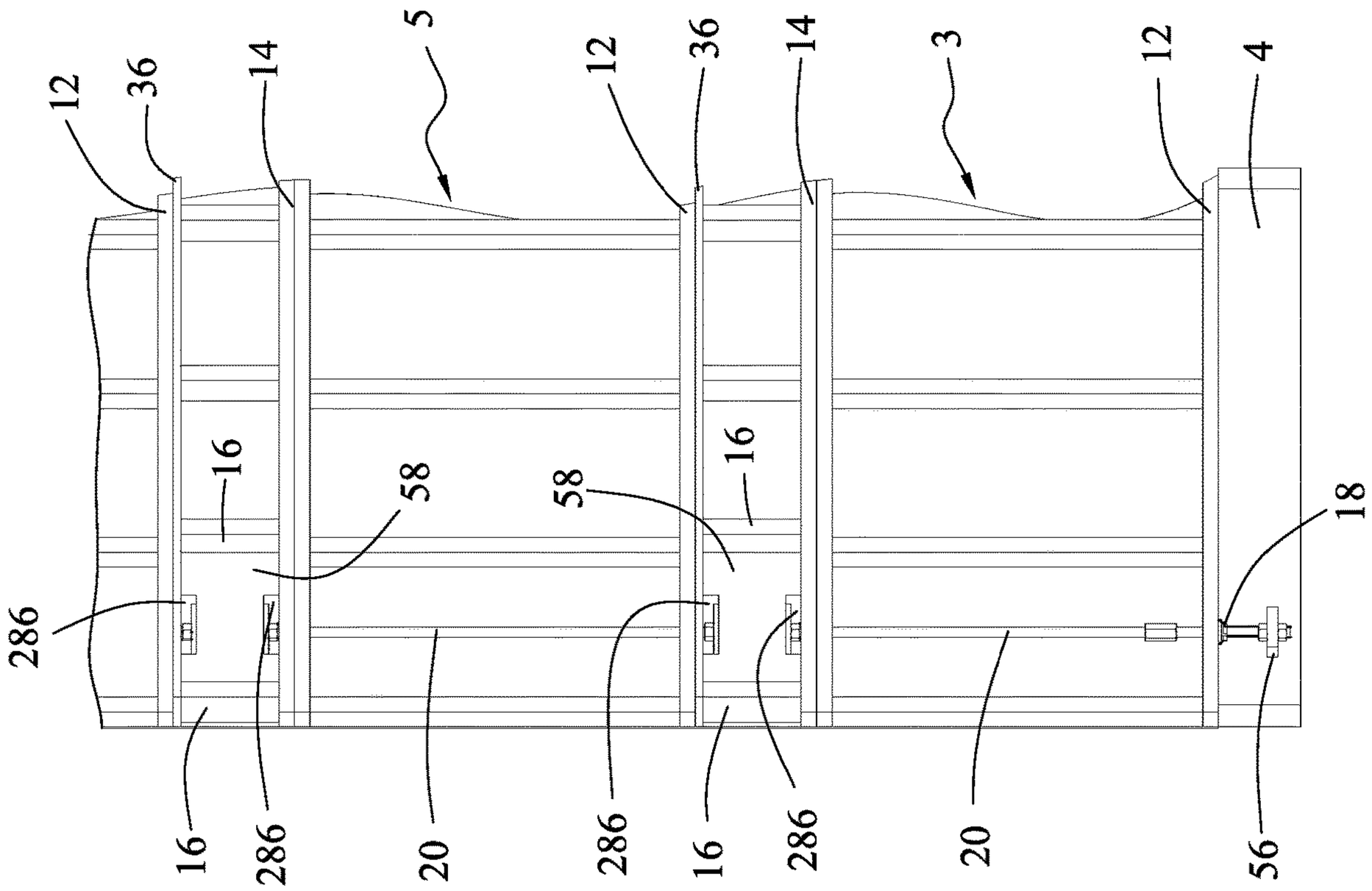


FIG. 150

FIG. 151



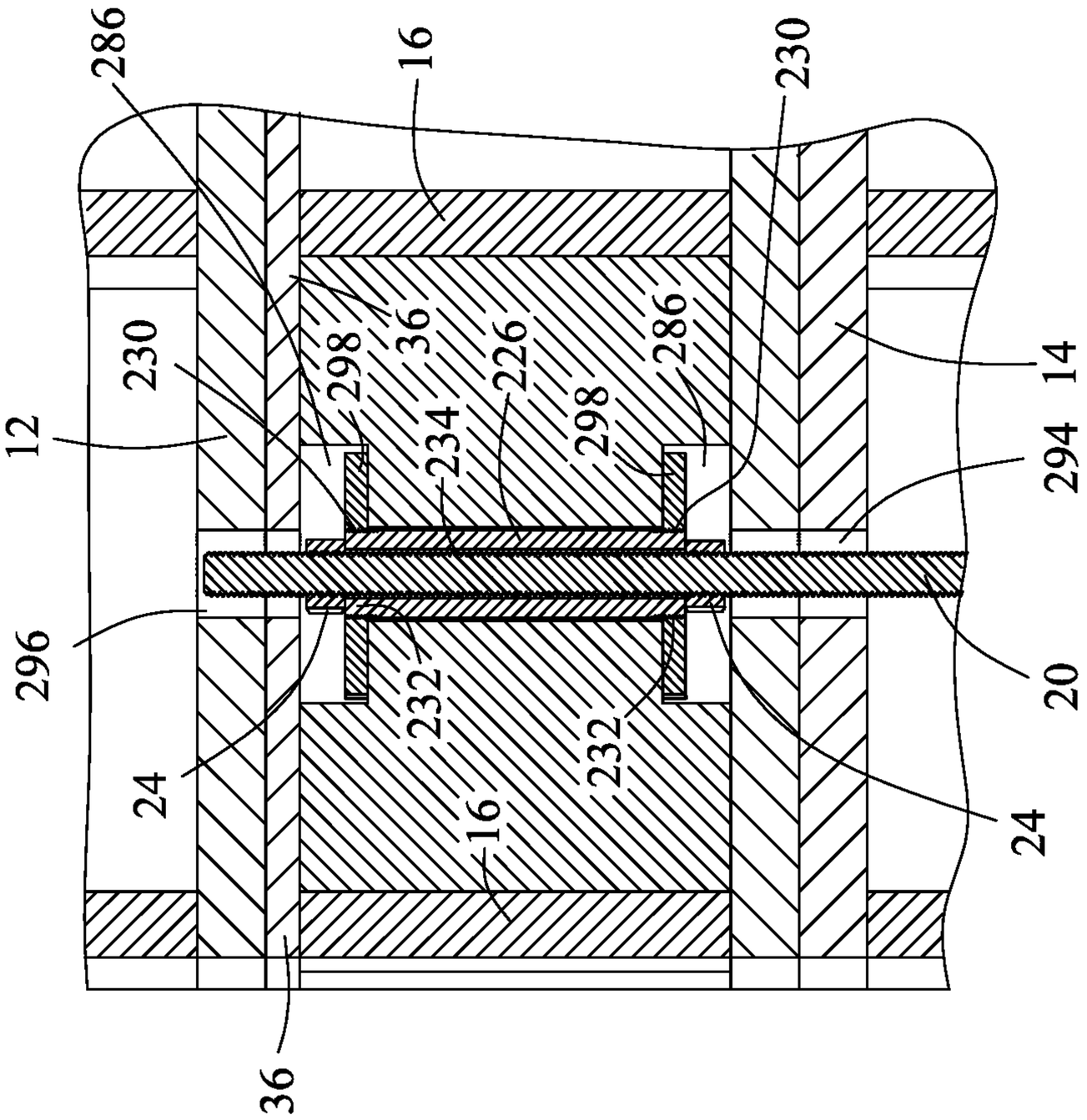


FIG. 153

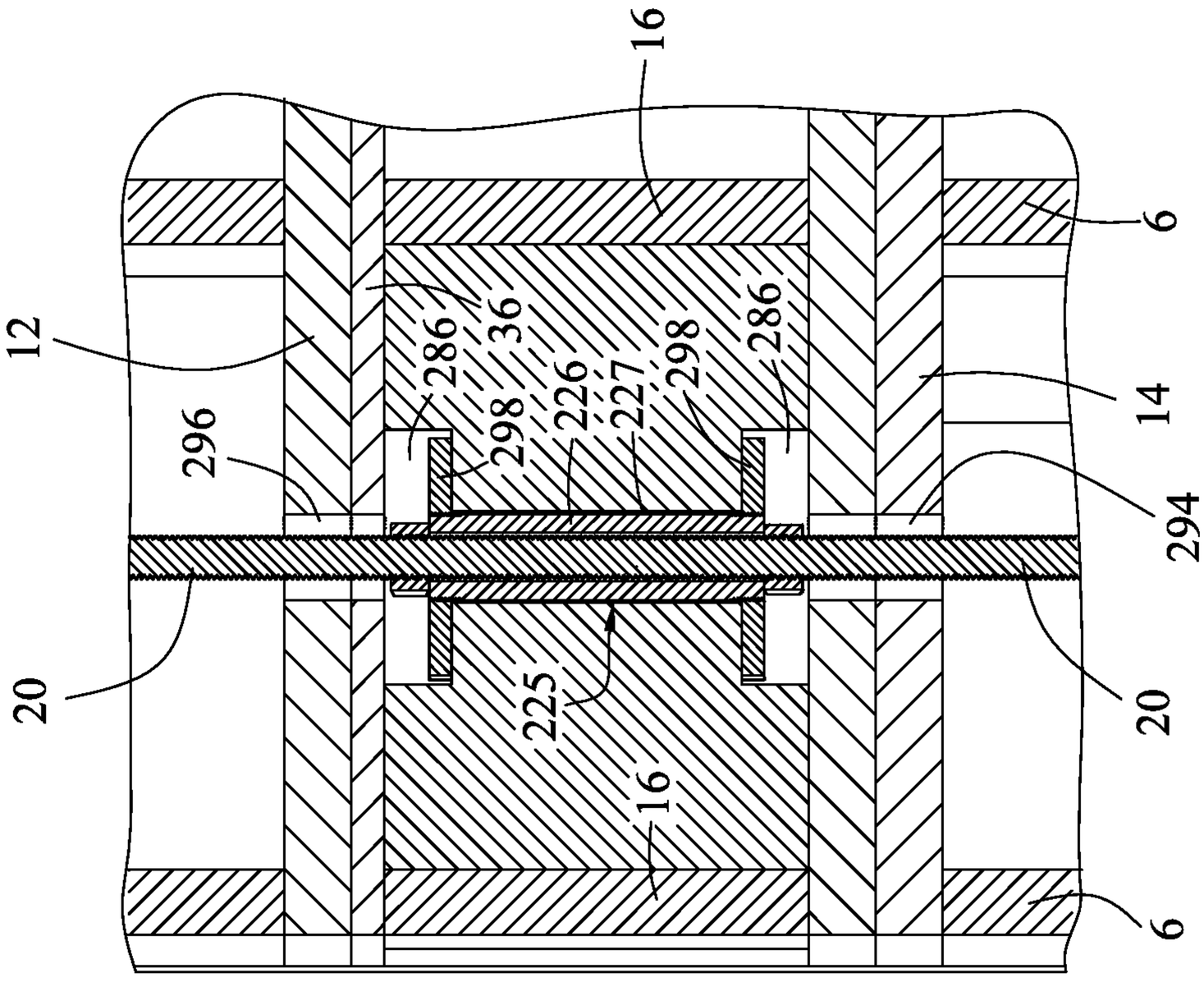


FIG. 152

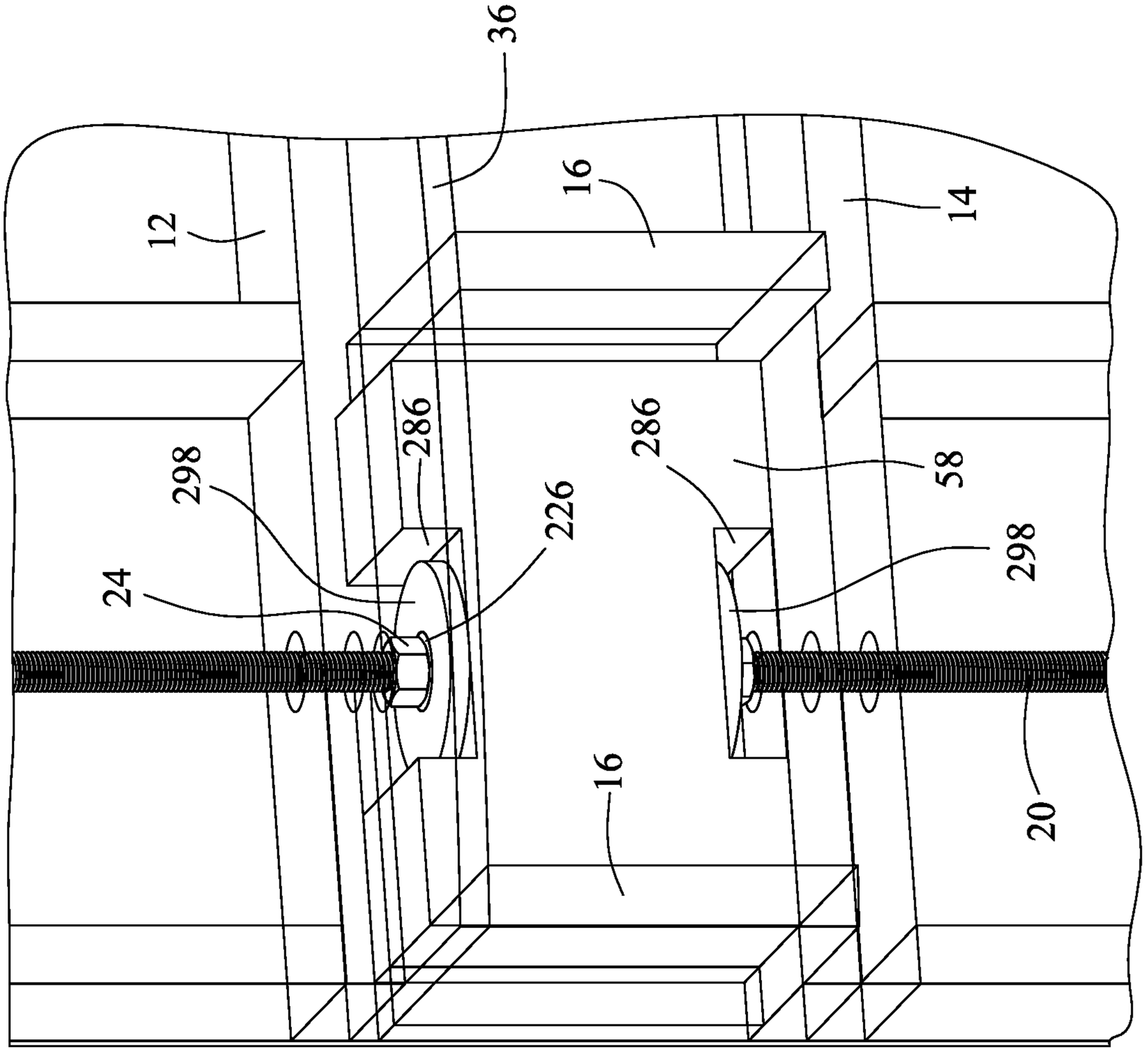


FIG. 154

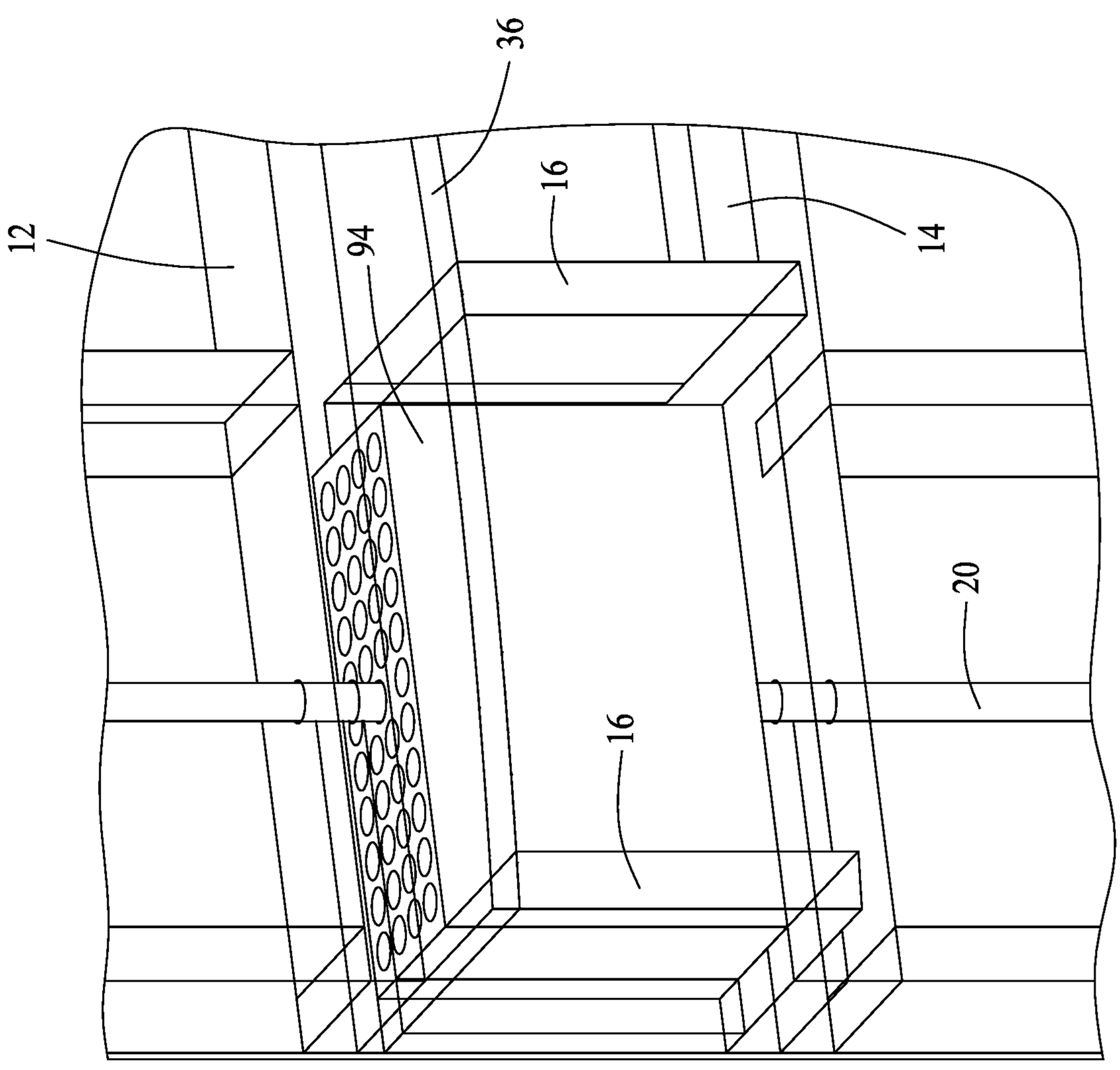


FIG. 155

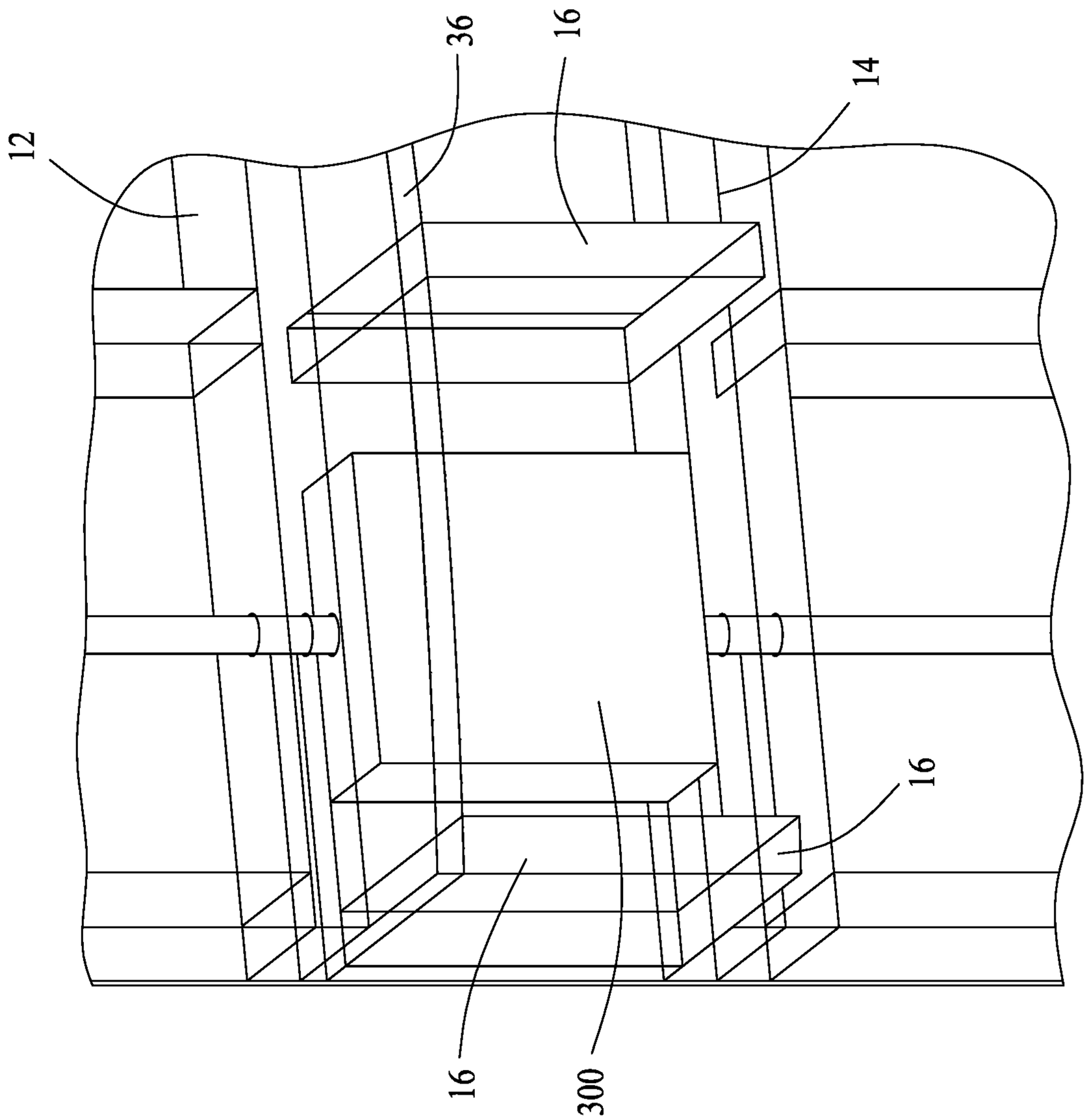


FIG. 156

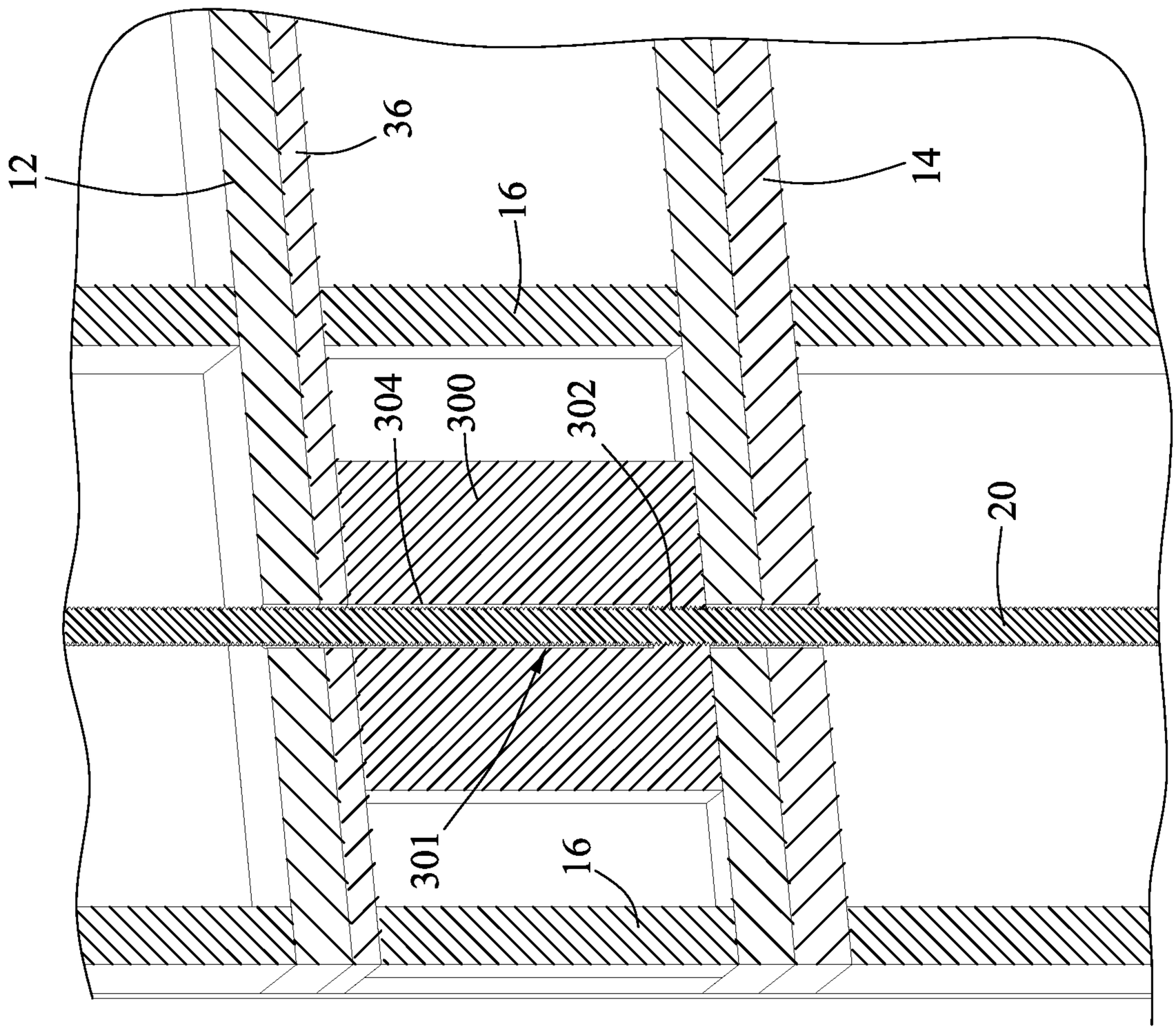


FIG. 157

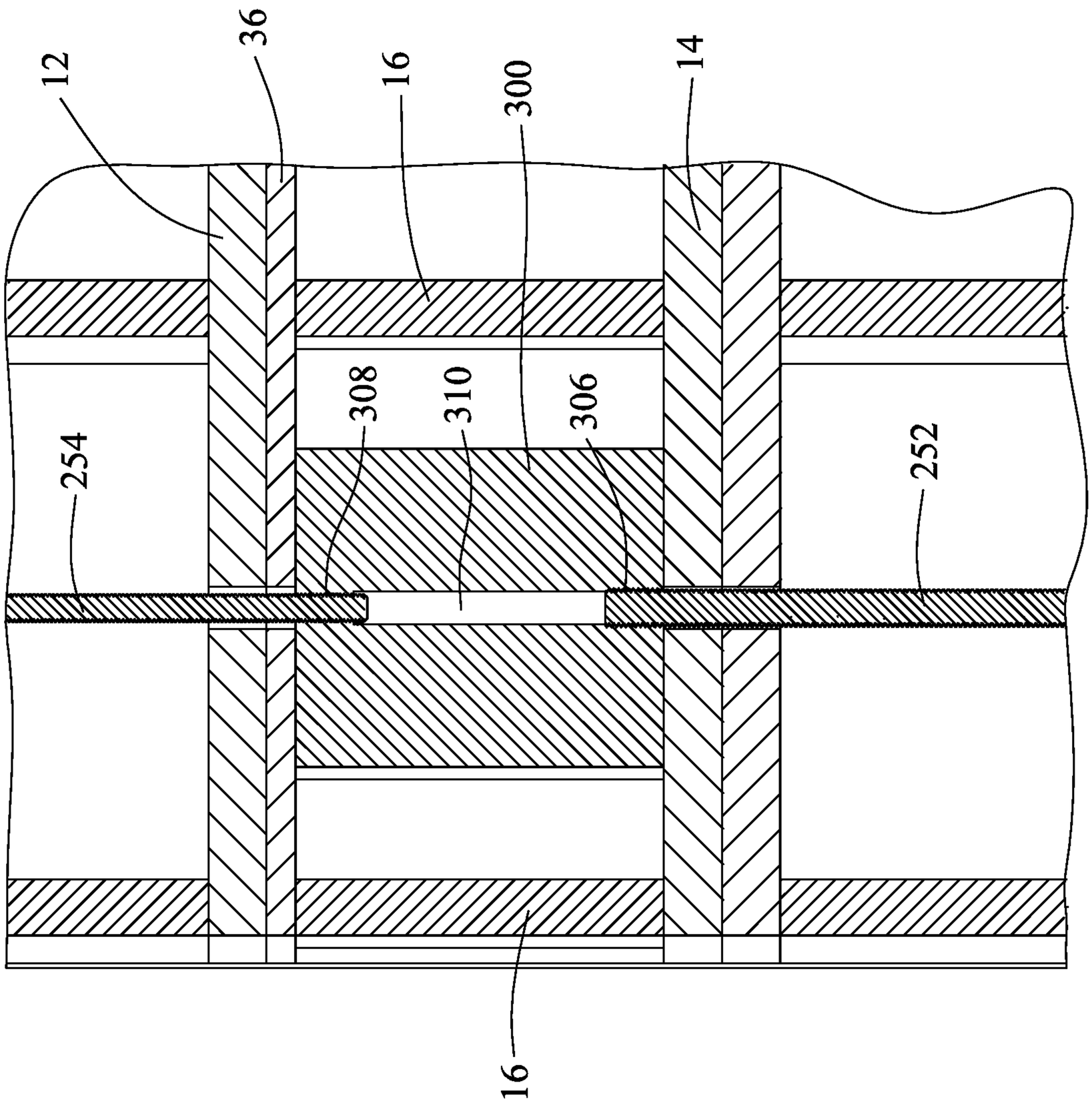


FIG. 158

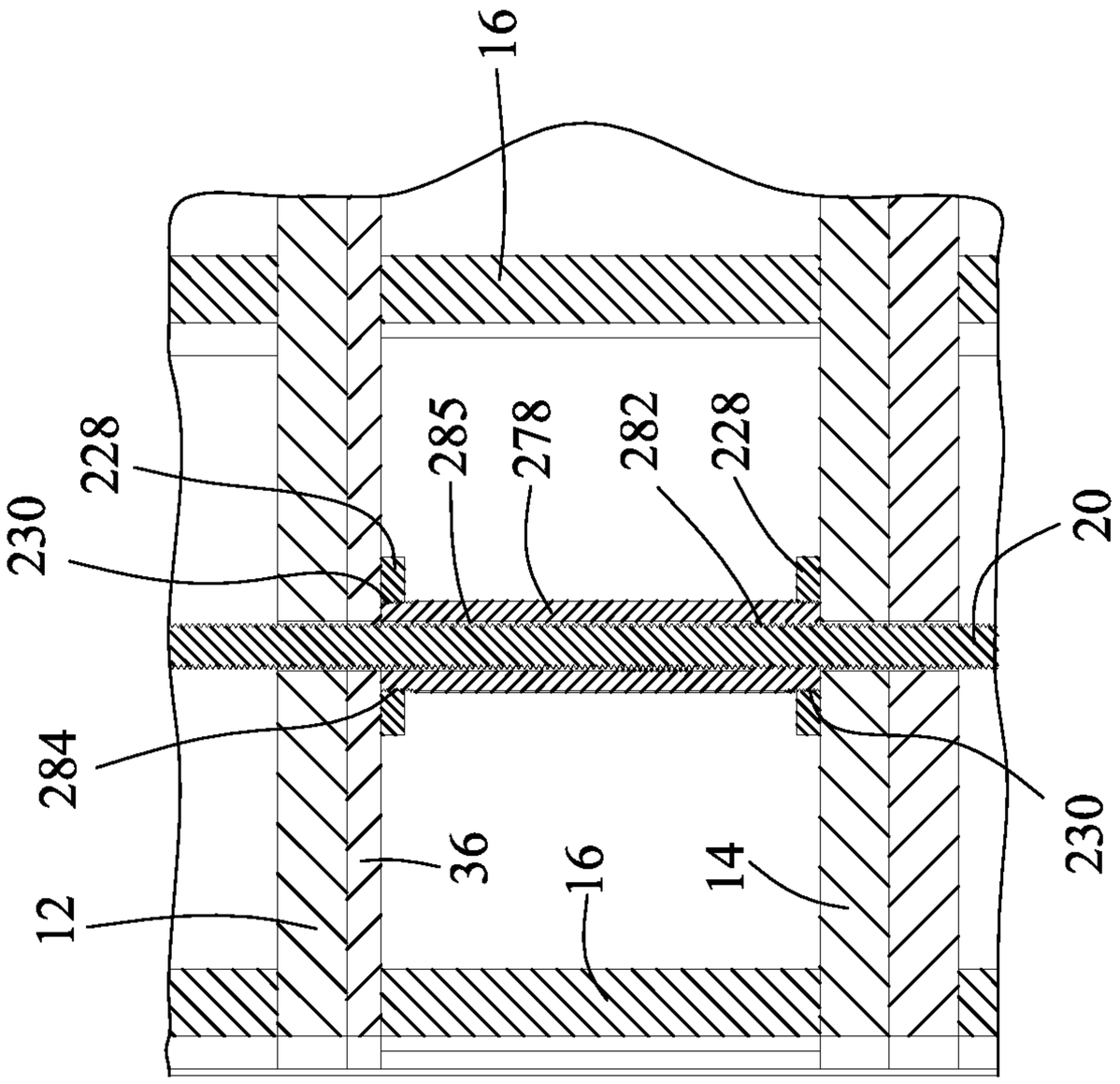


FIG. 160

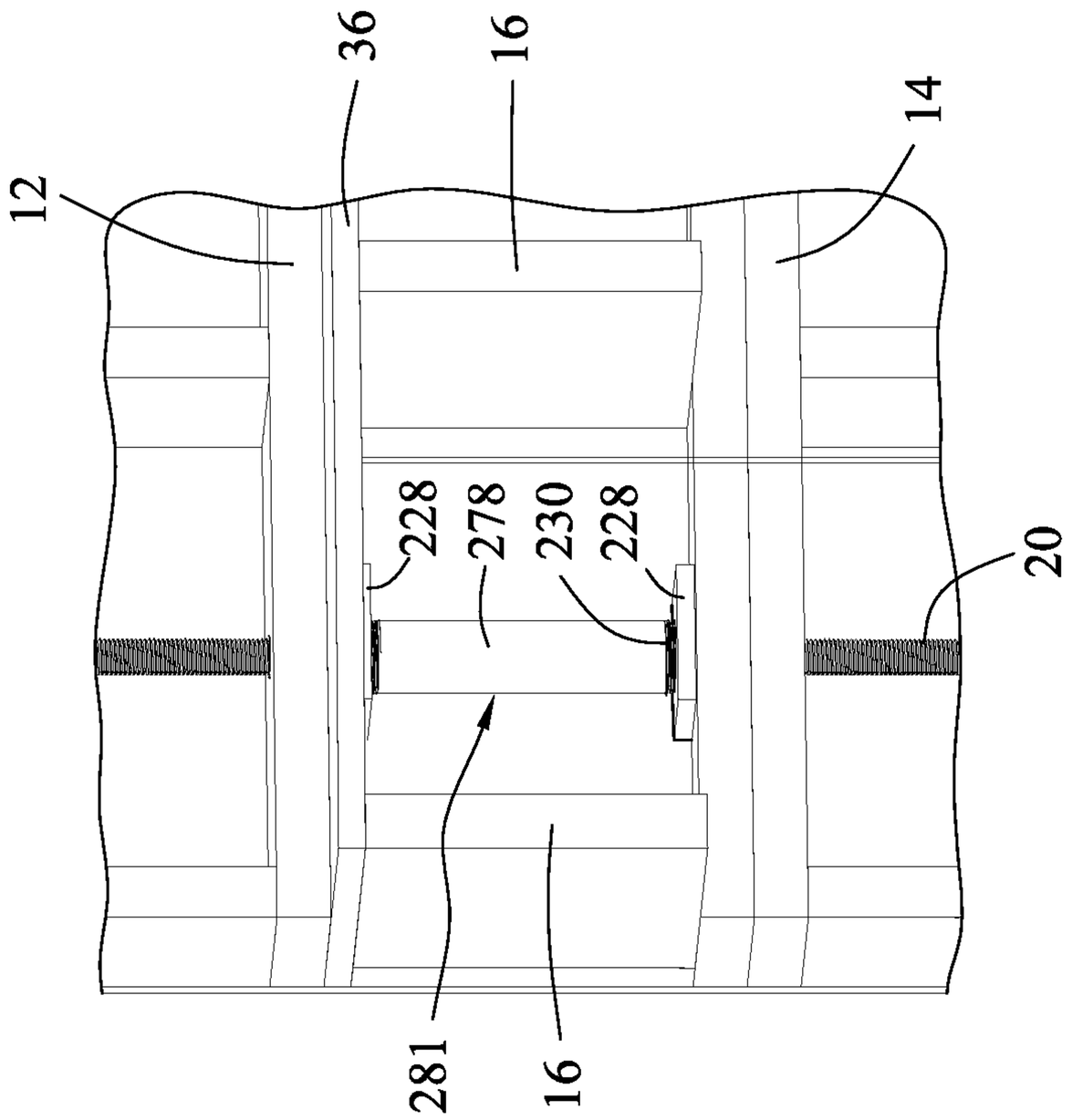


FIG. 159

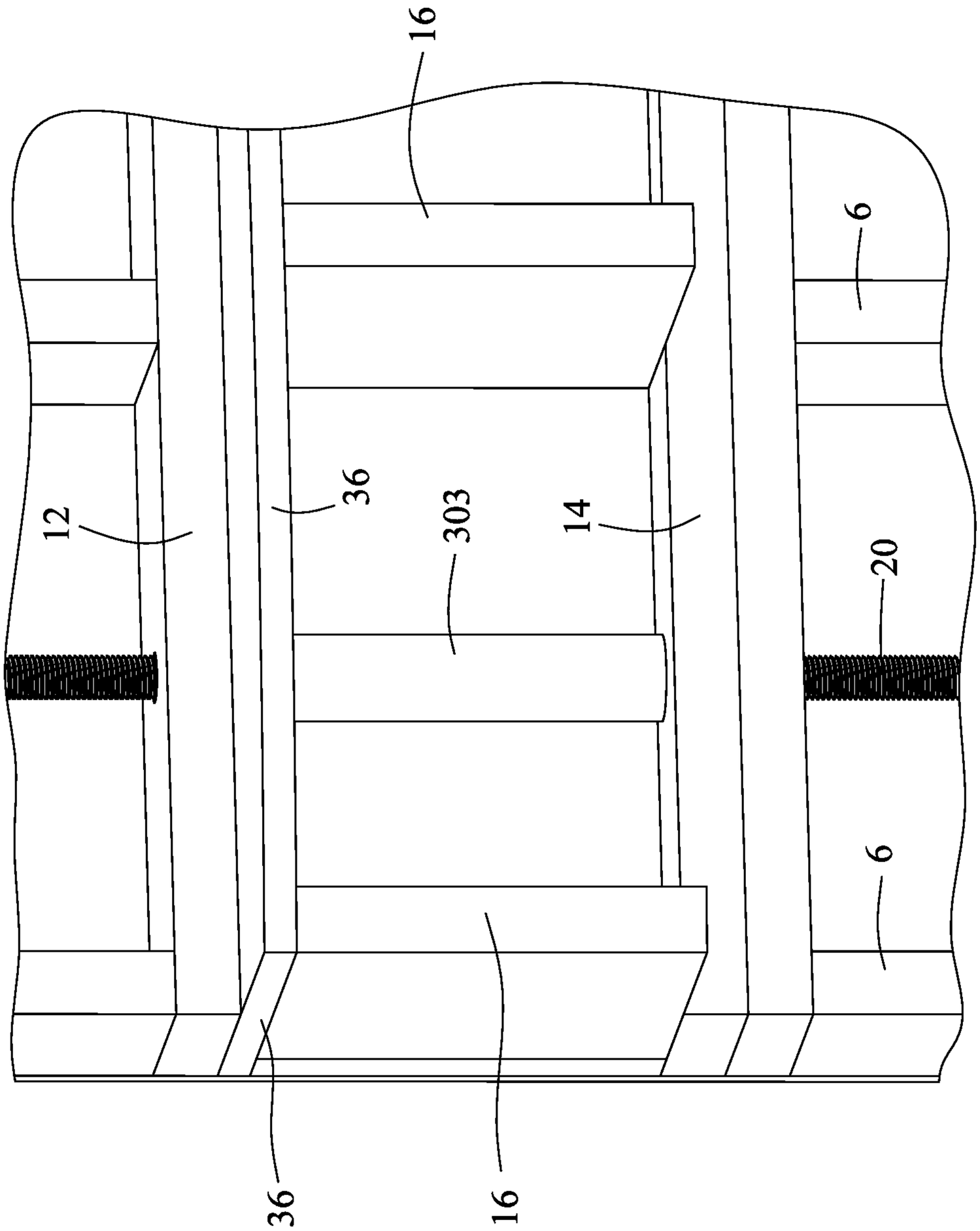


FIG. 161

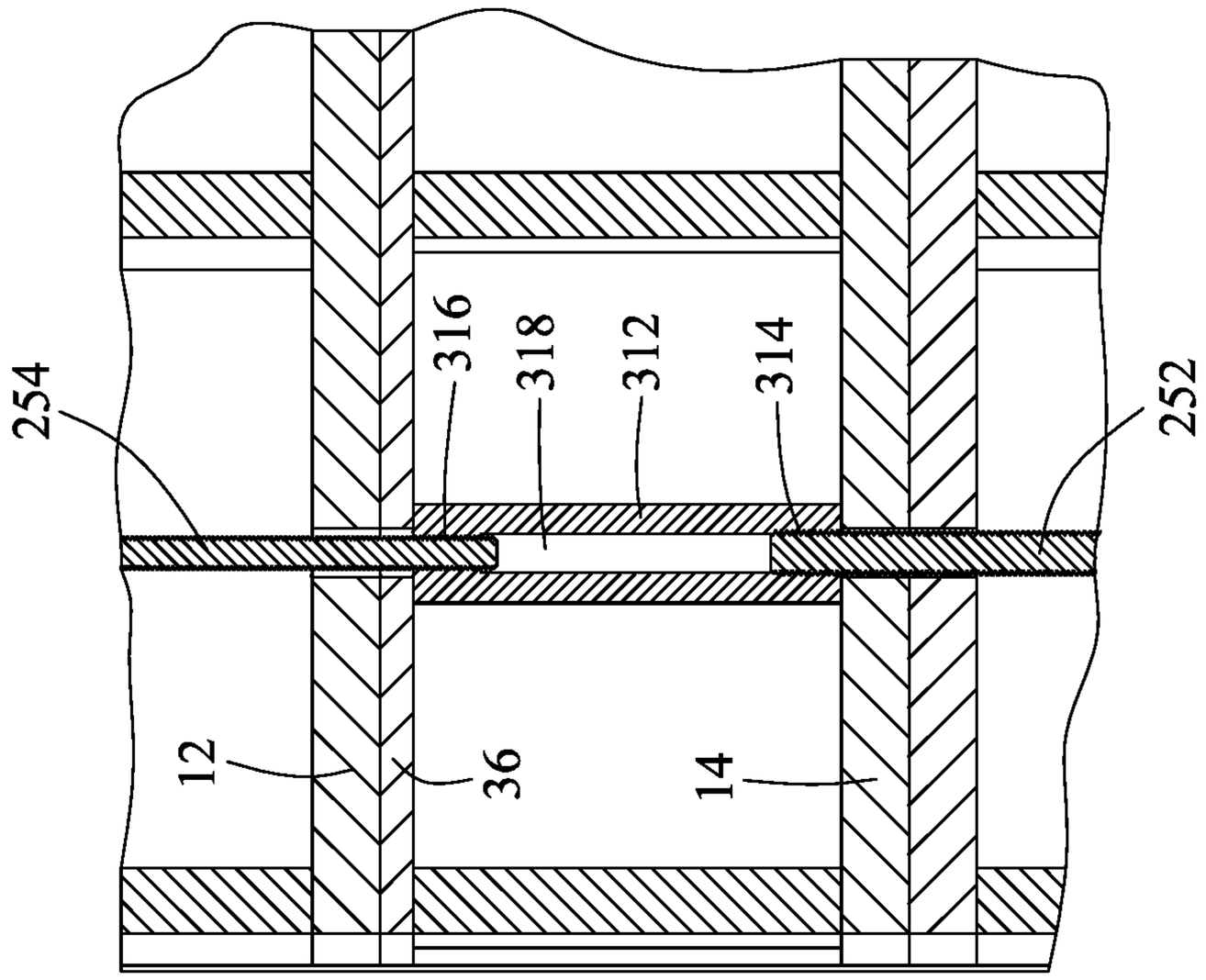


FIG. 163

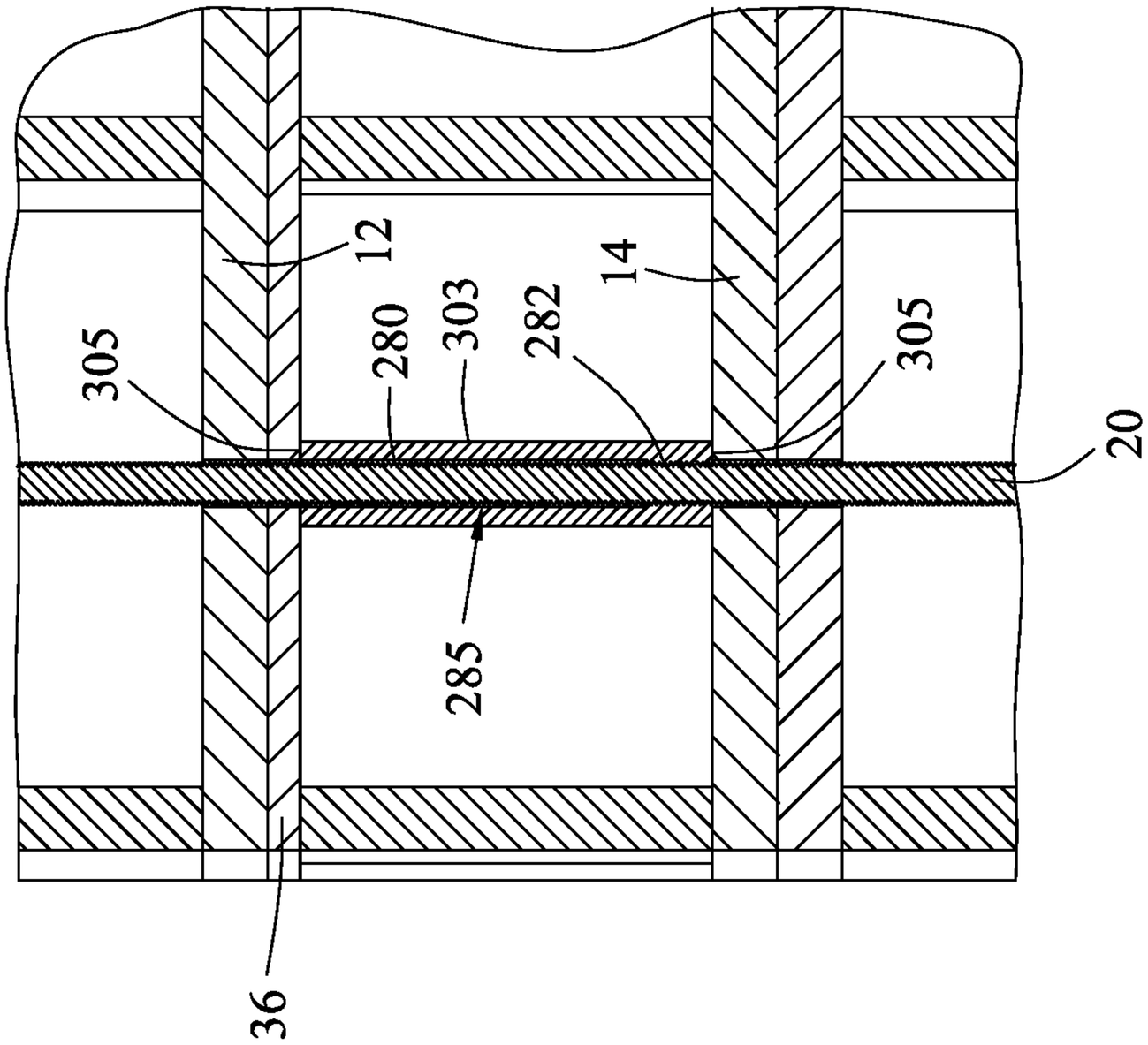


FIG. 162

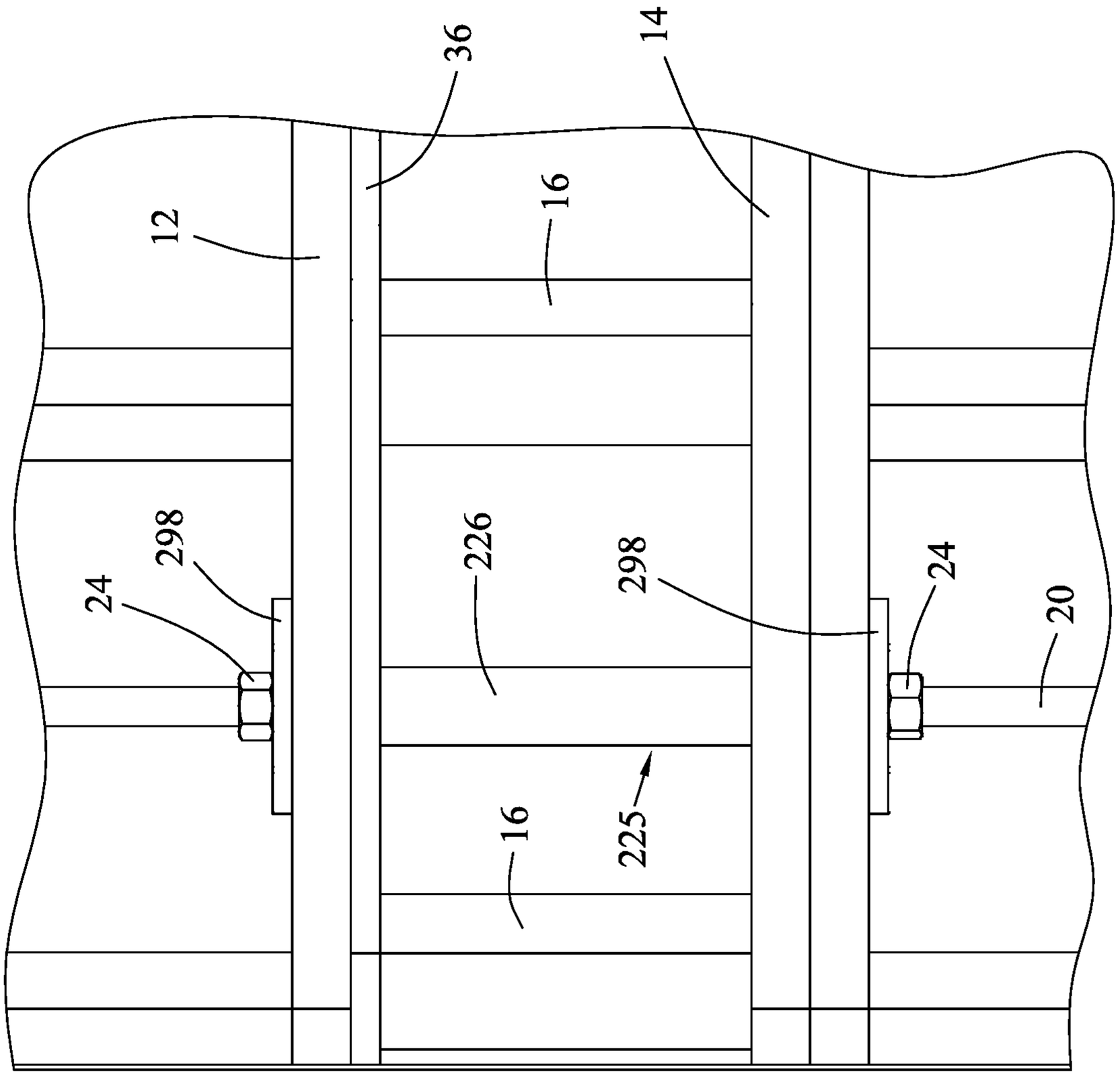


FIG. 164

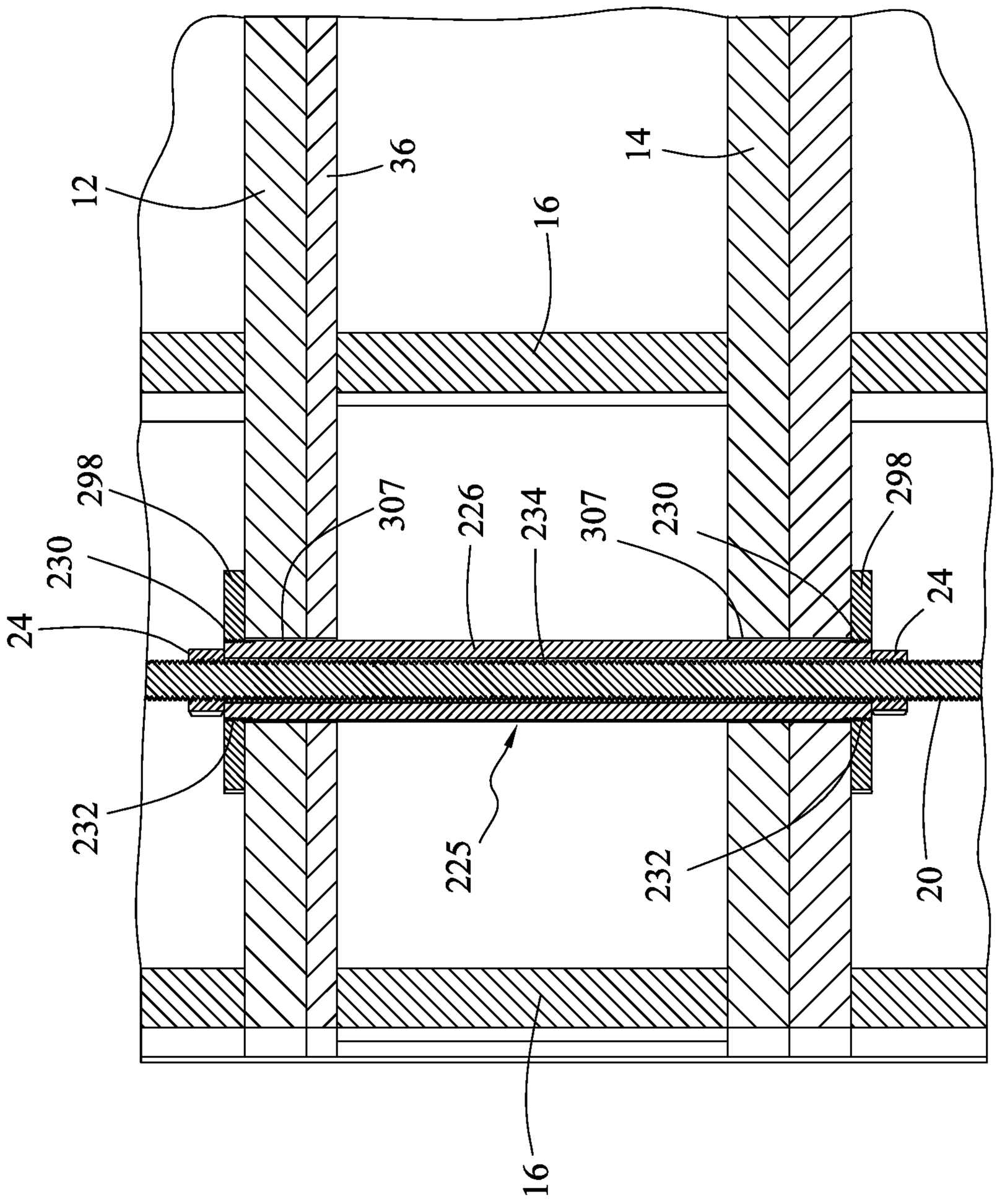
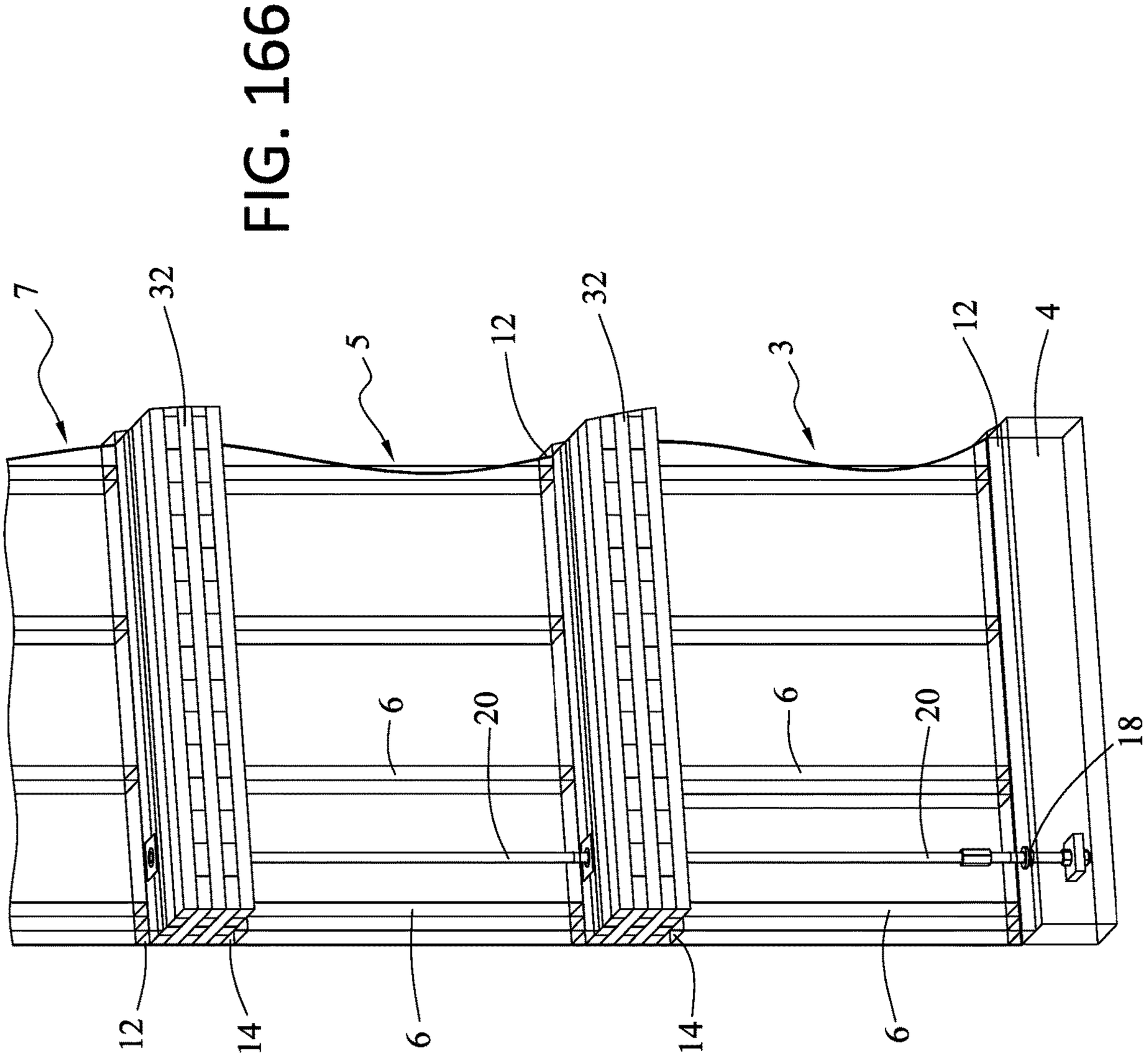


FIG. 165

FIG. 166



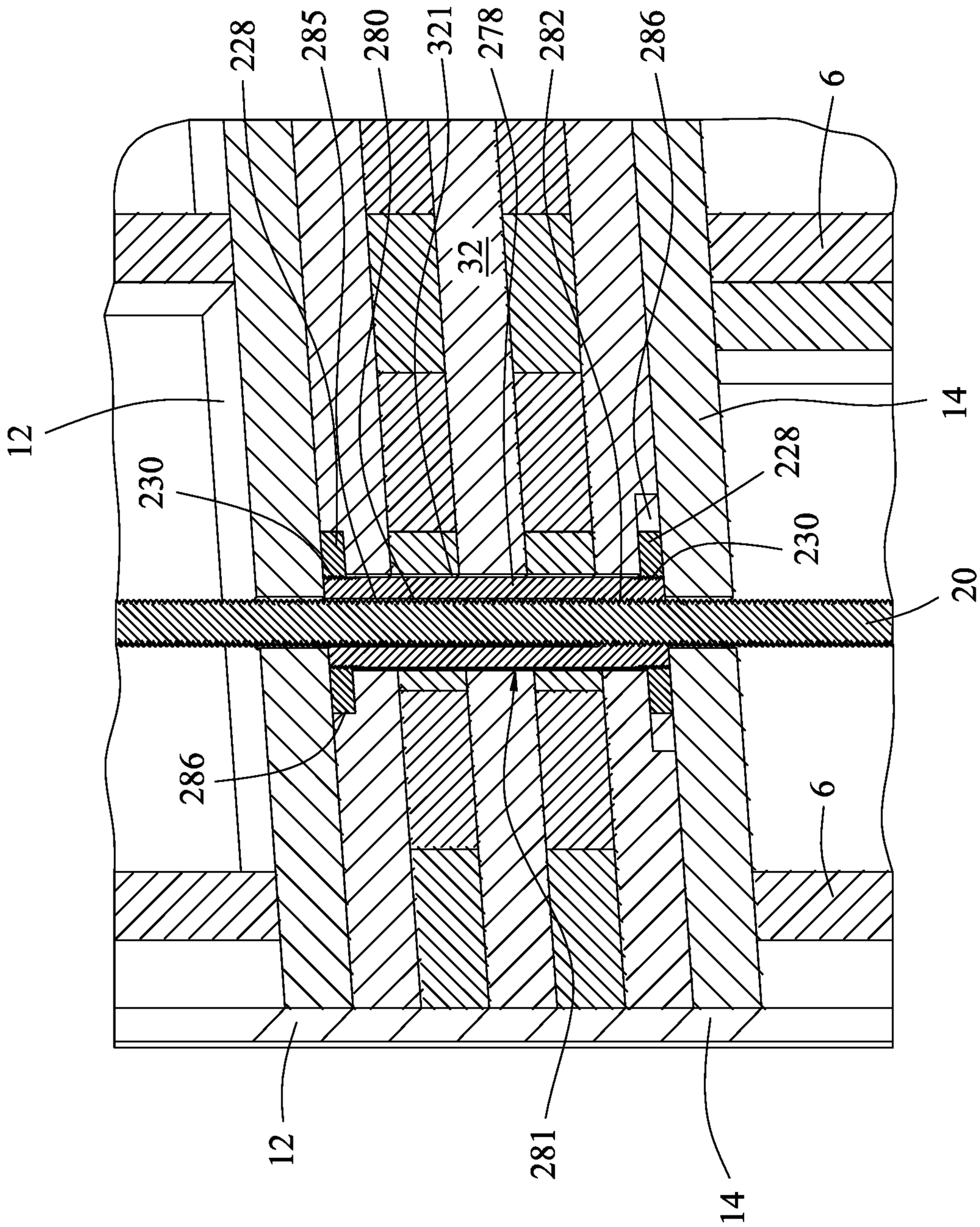

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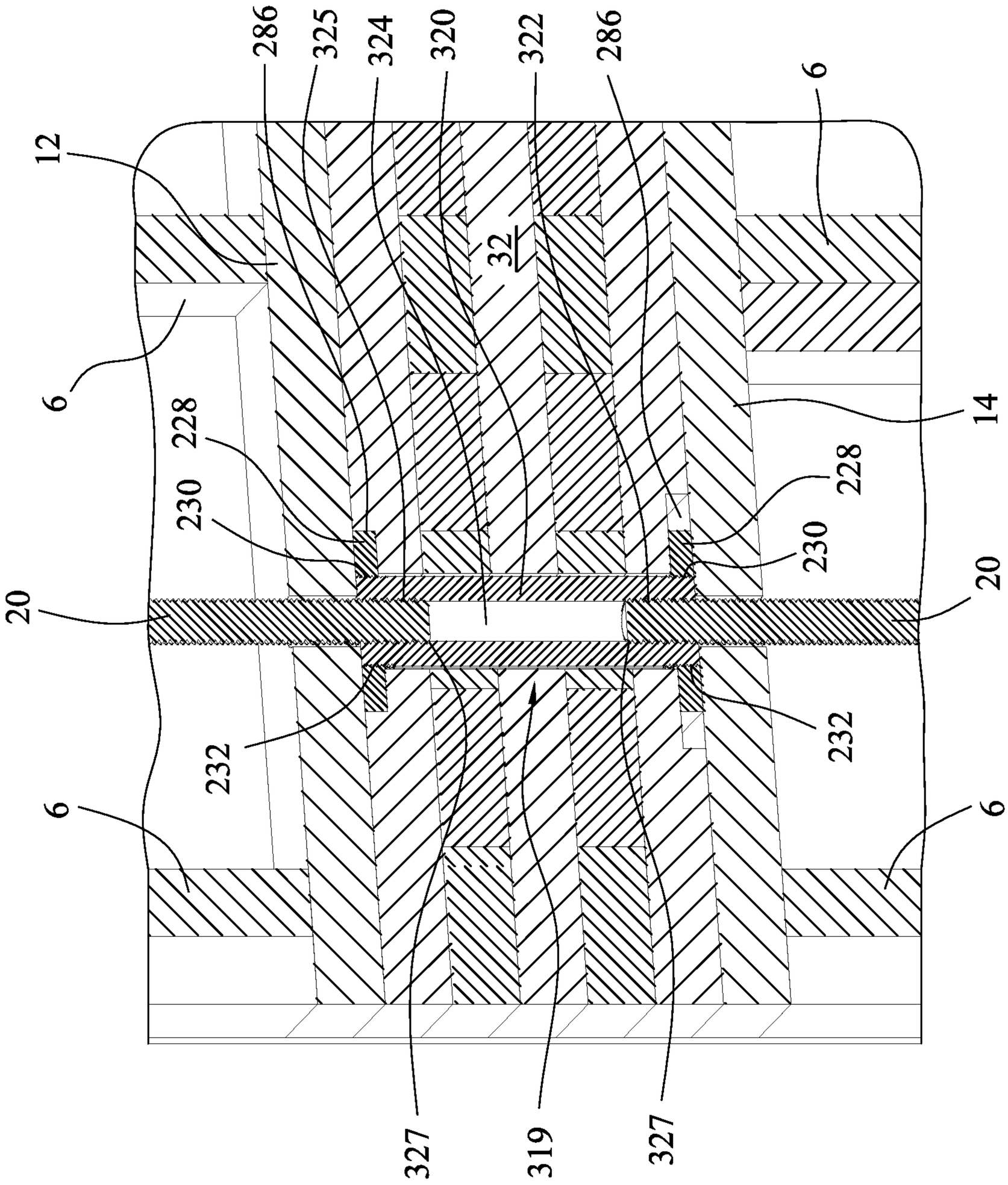
FIG. 167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325
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286
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20
20
232
232
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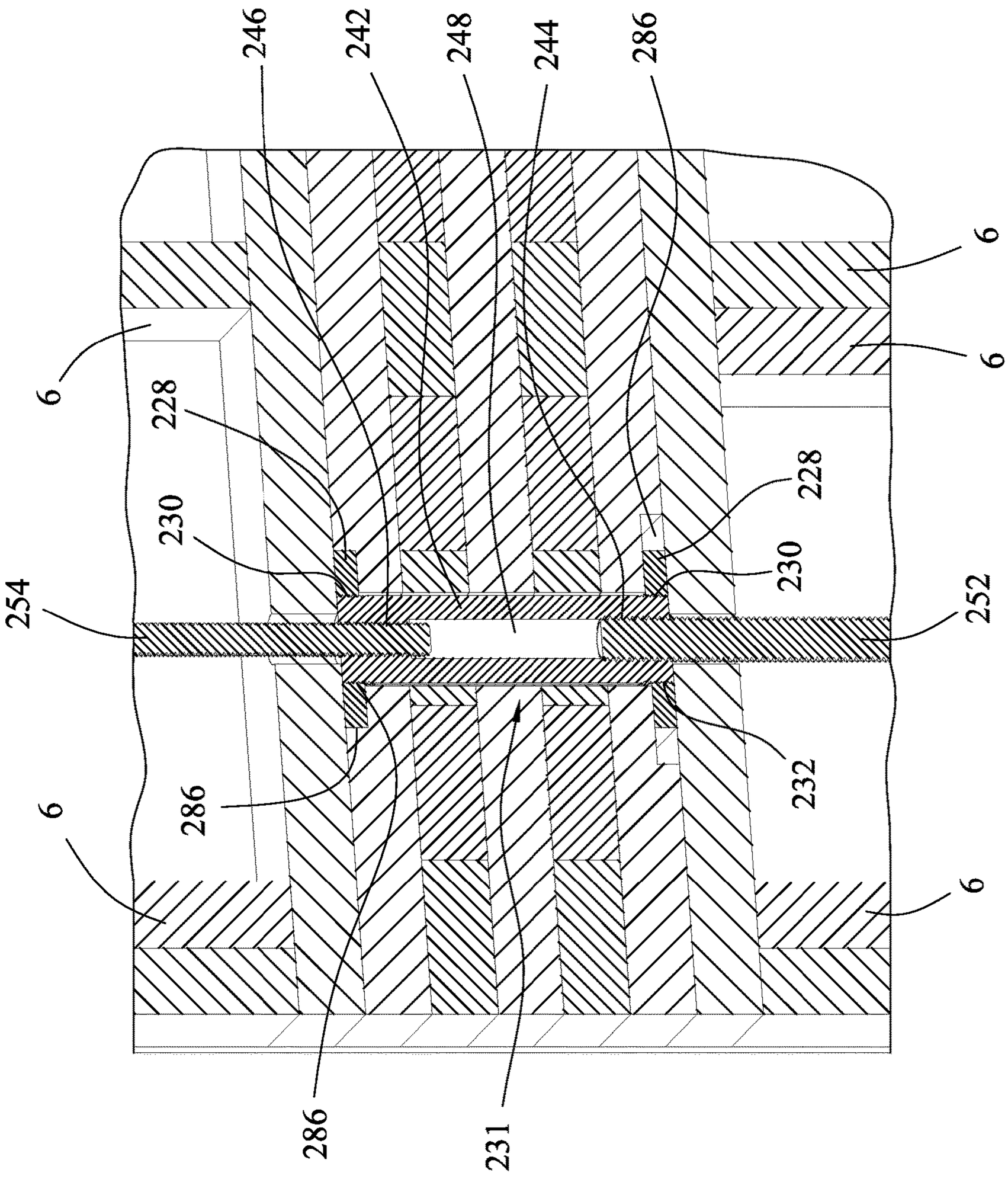
6
327
319
327

FIG. 168


246
242
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286
231

FIG. 169

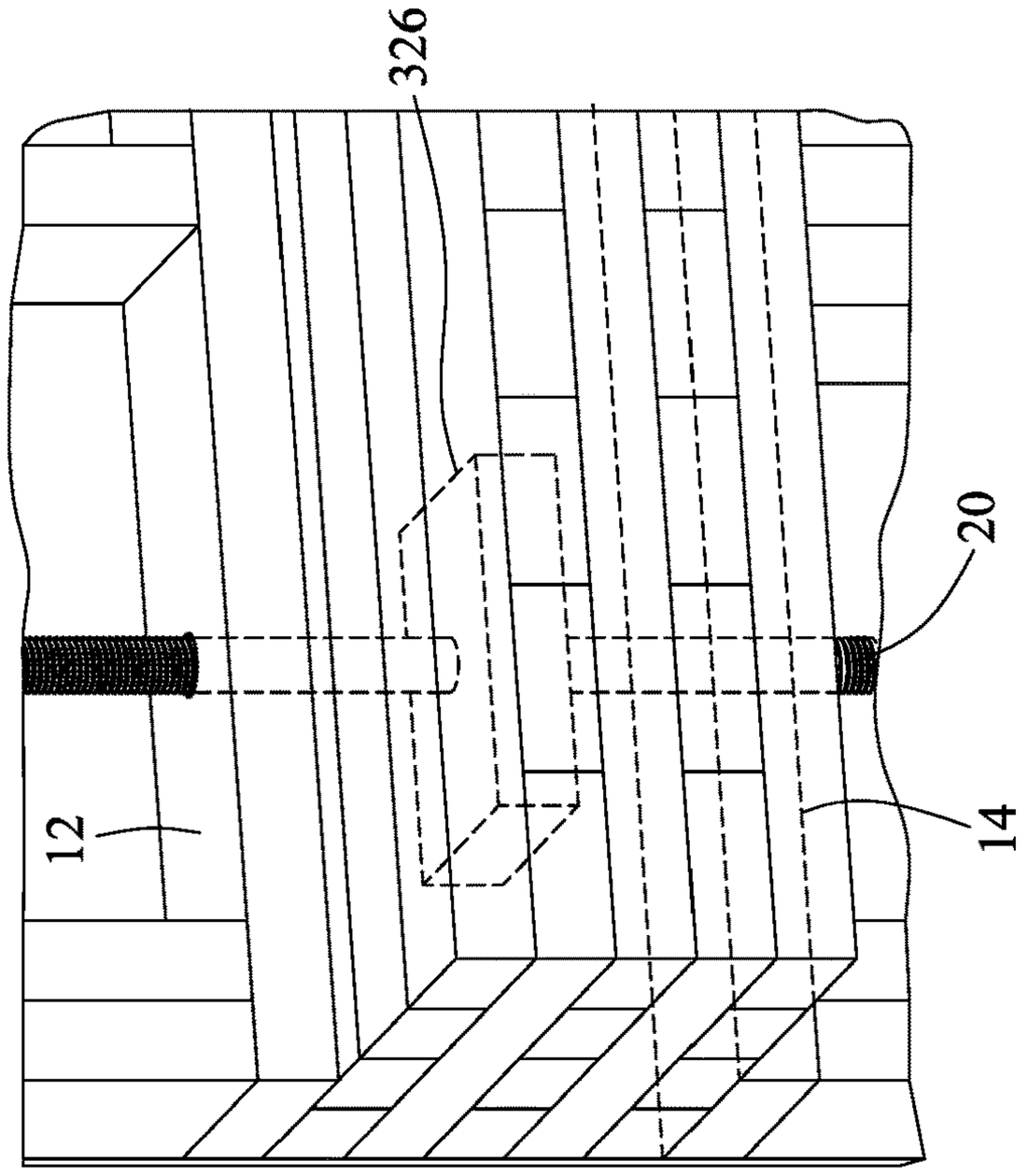


FIG. 171

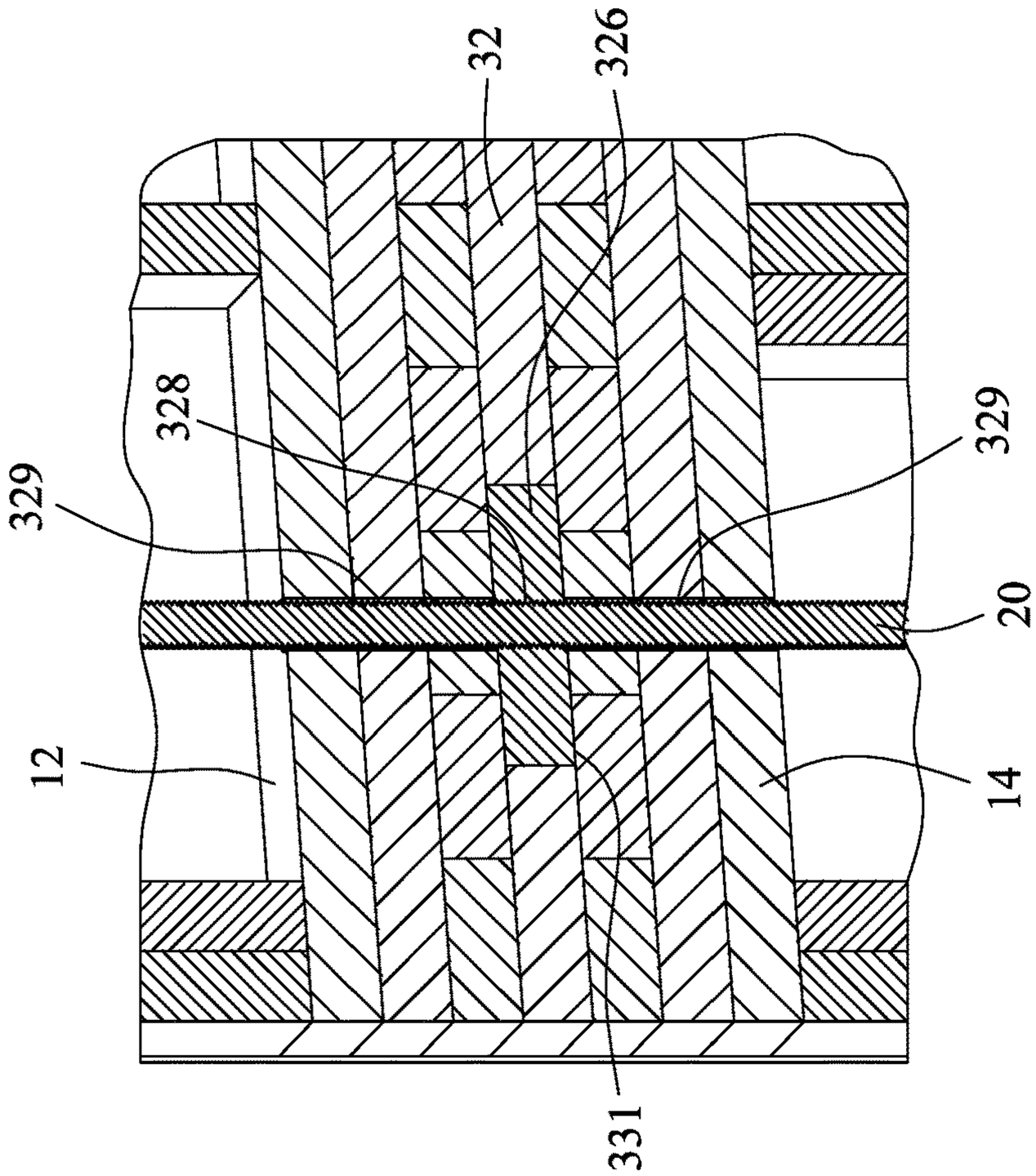


FIG. 170

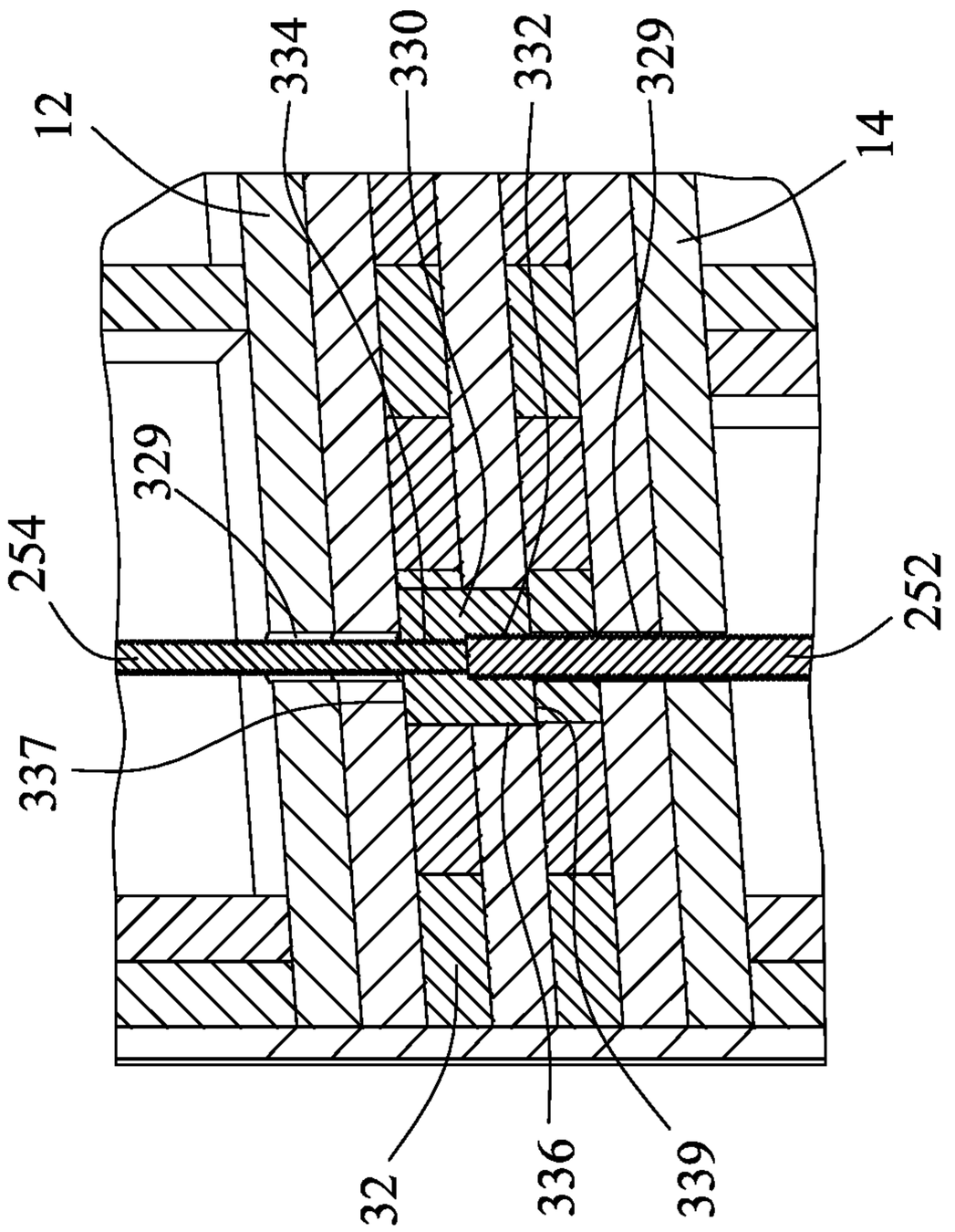


FIG. 173

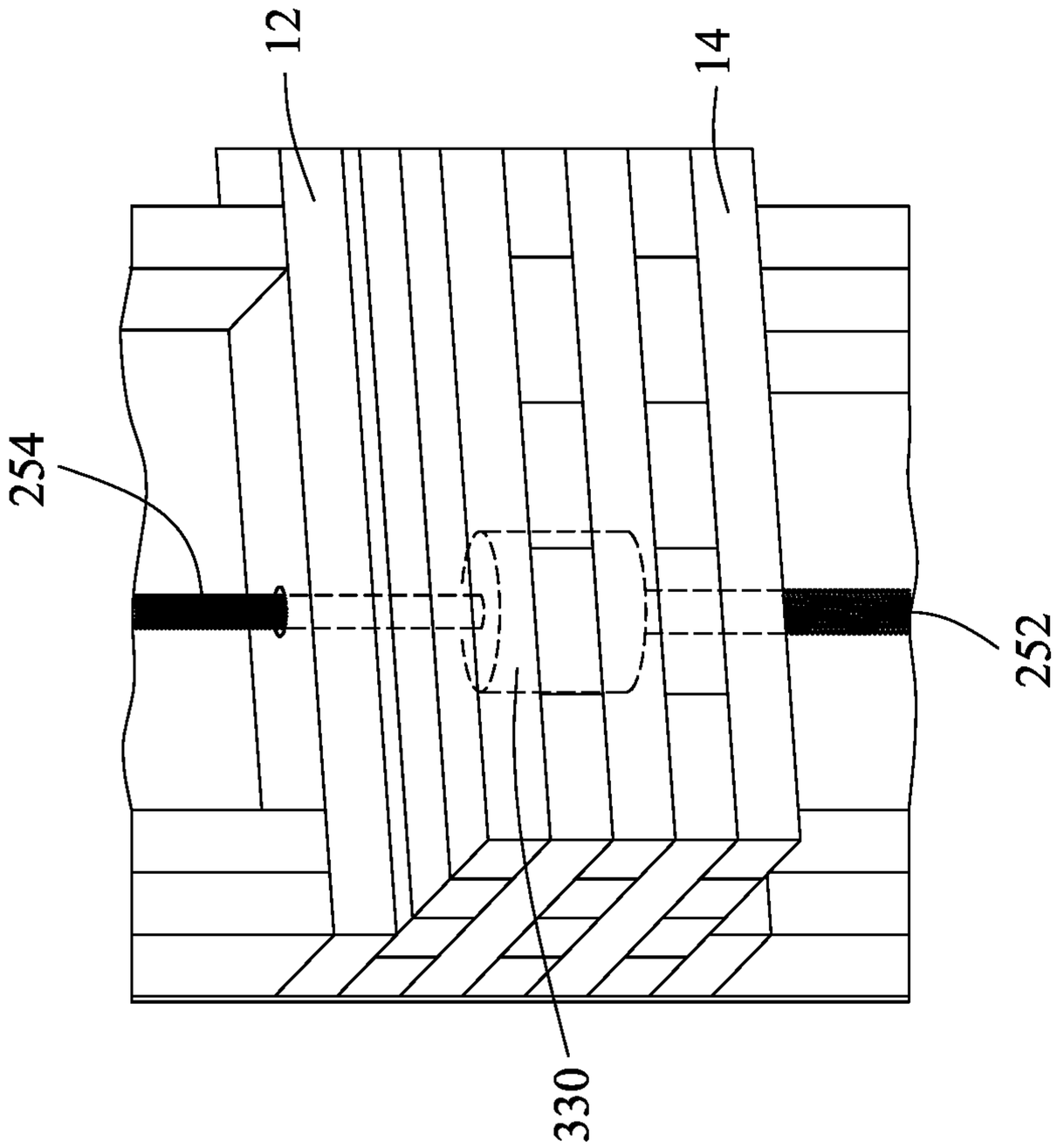


FIG. 172

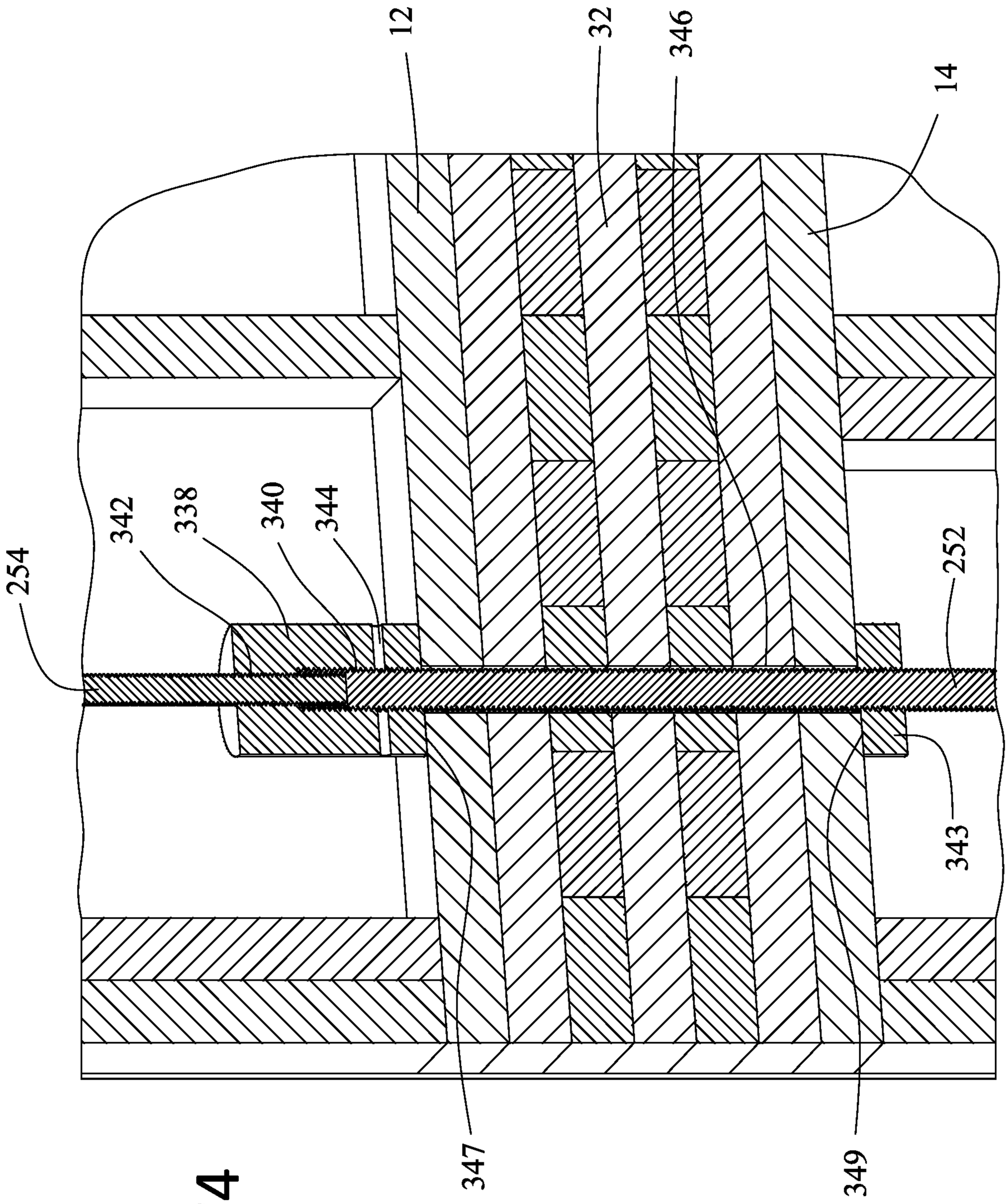


FIG. 174

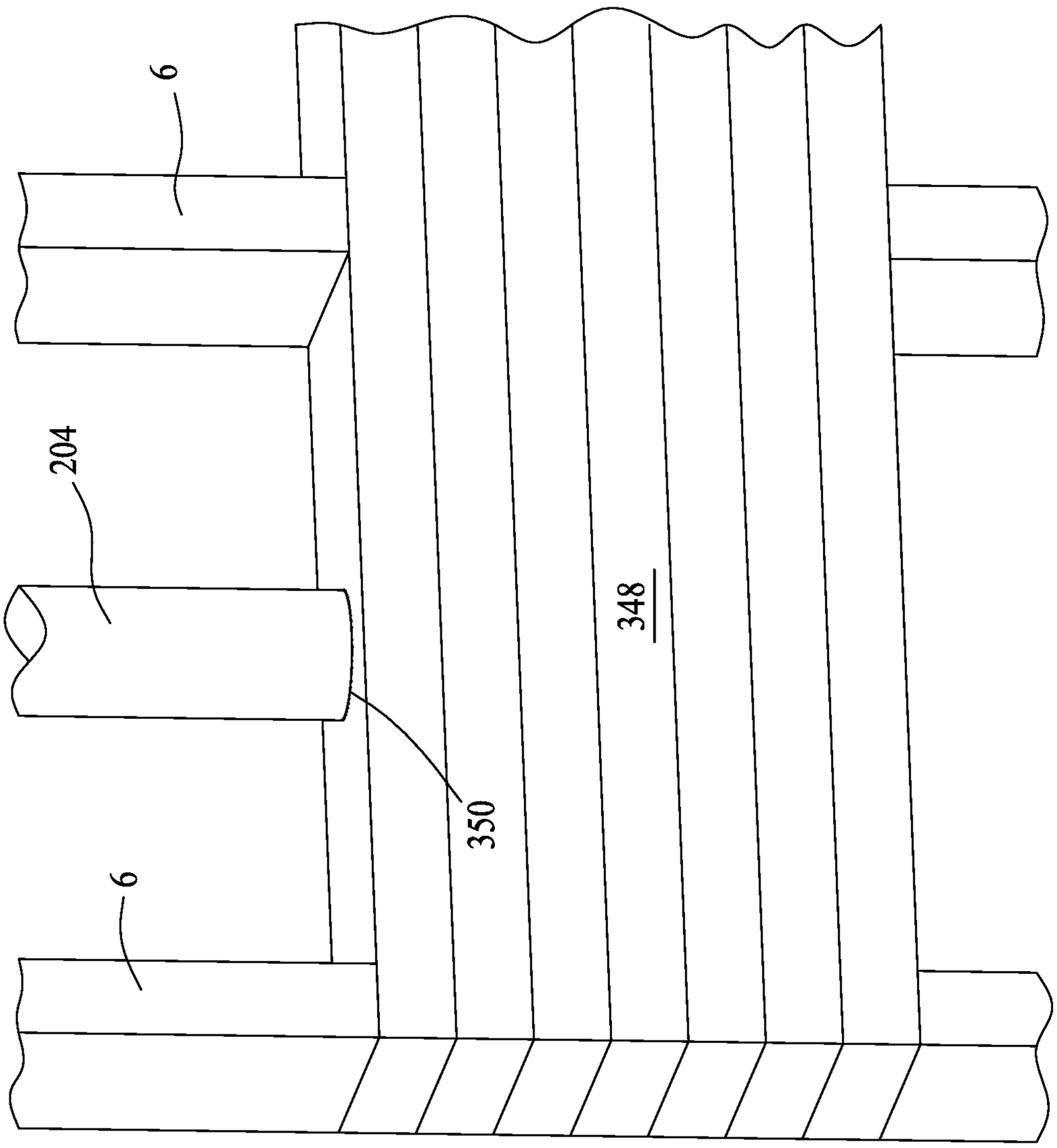


FIG. 175

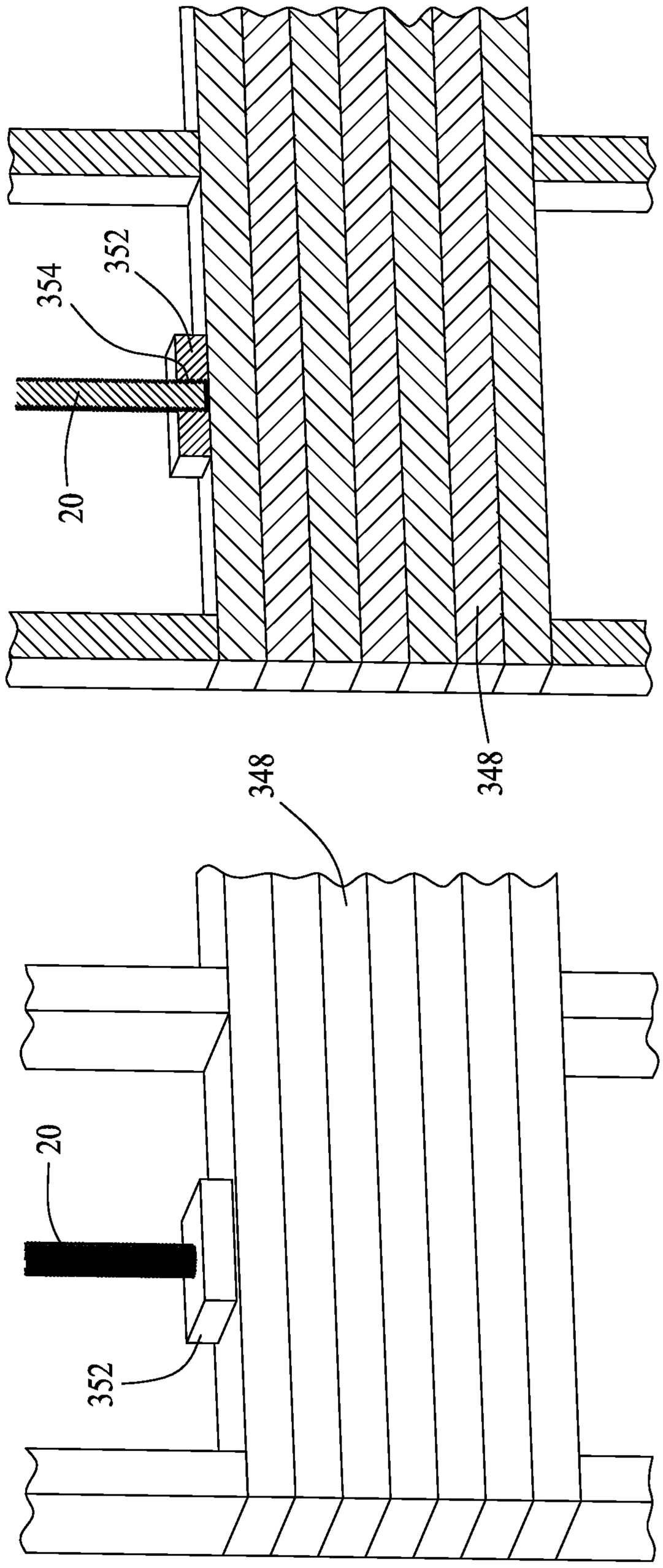


FIG. 177

FIG. 176

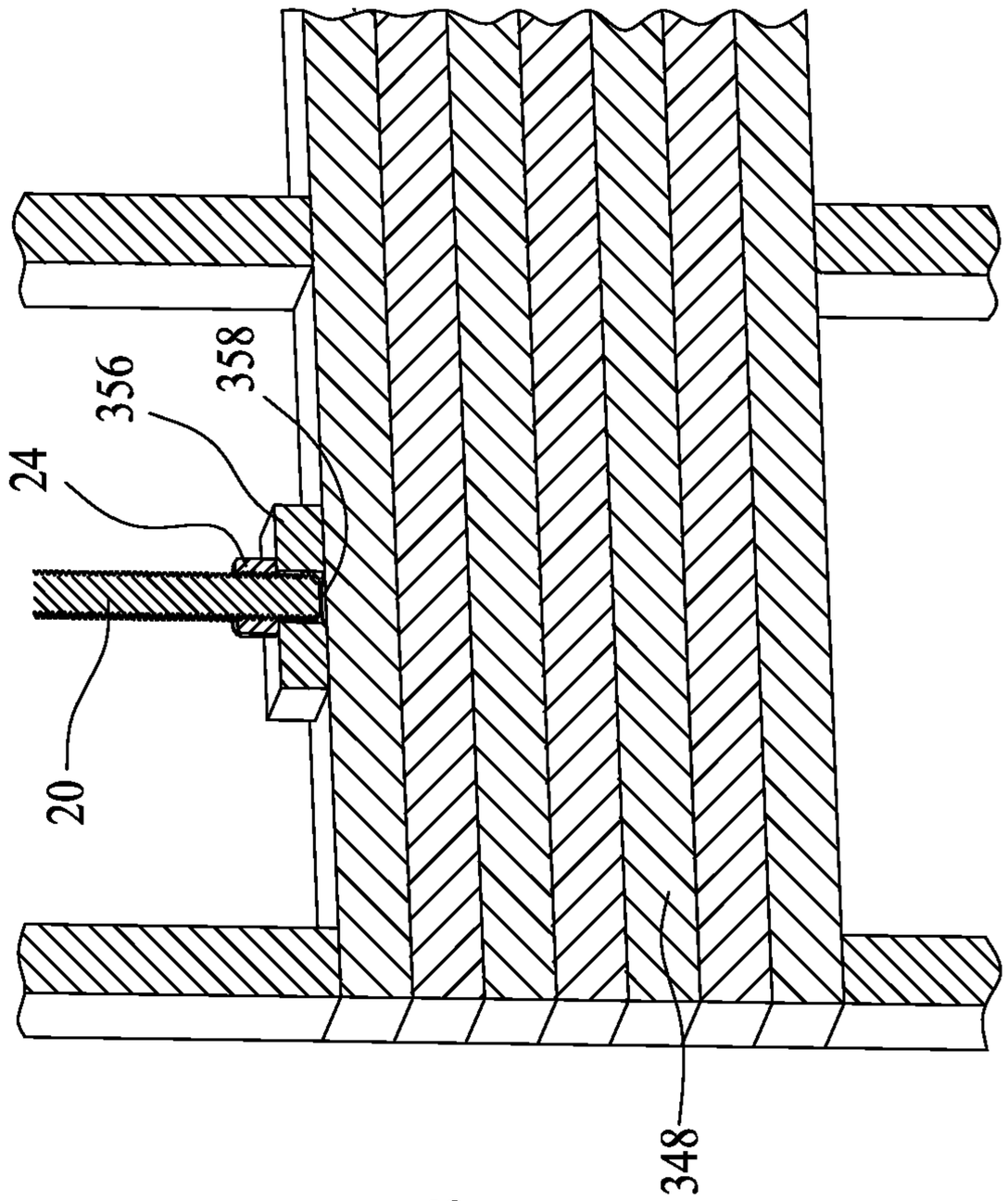


FIG. 179

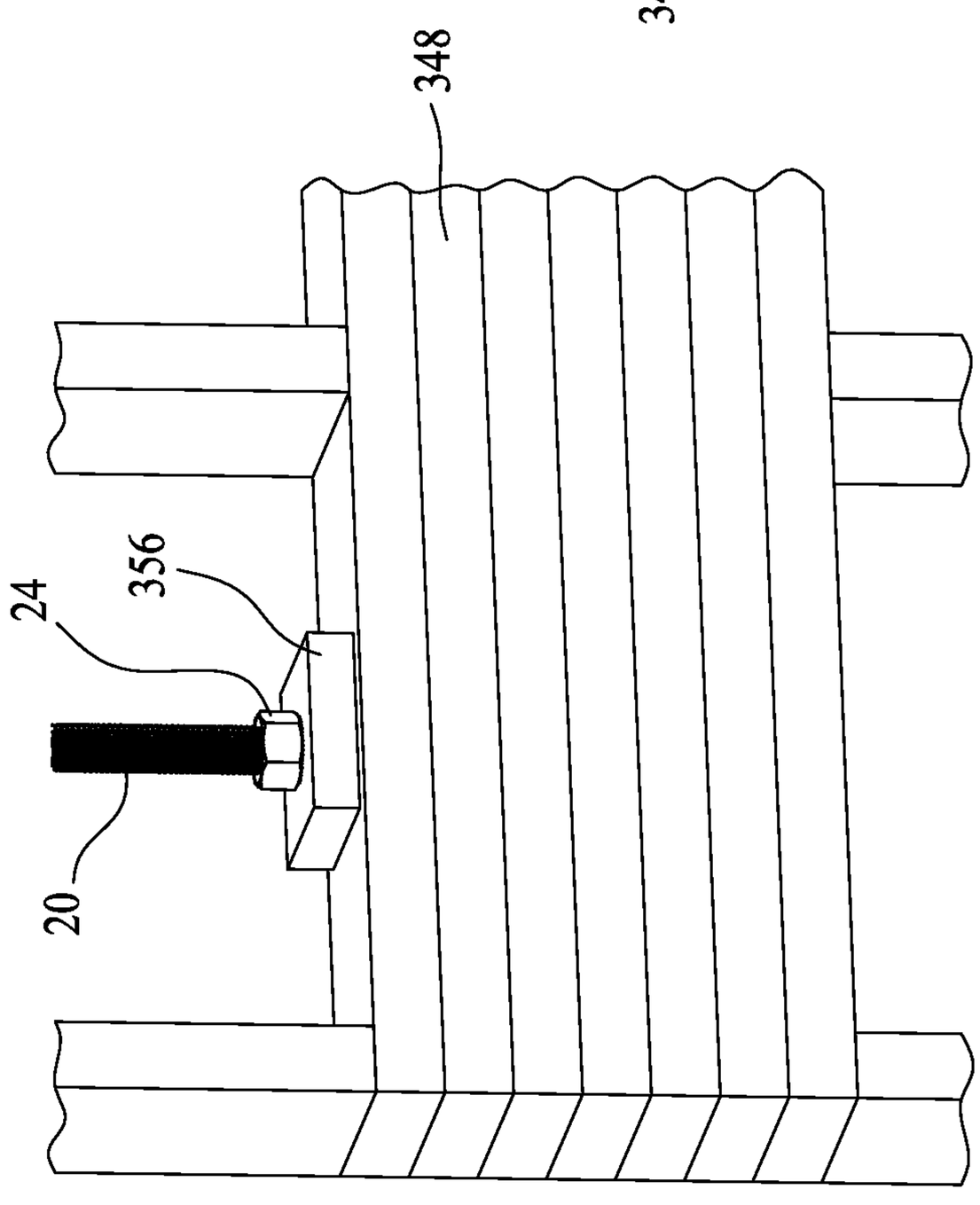


FIG. 178

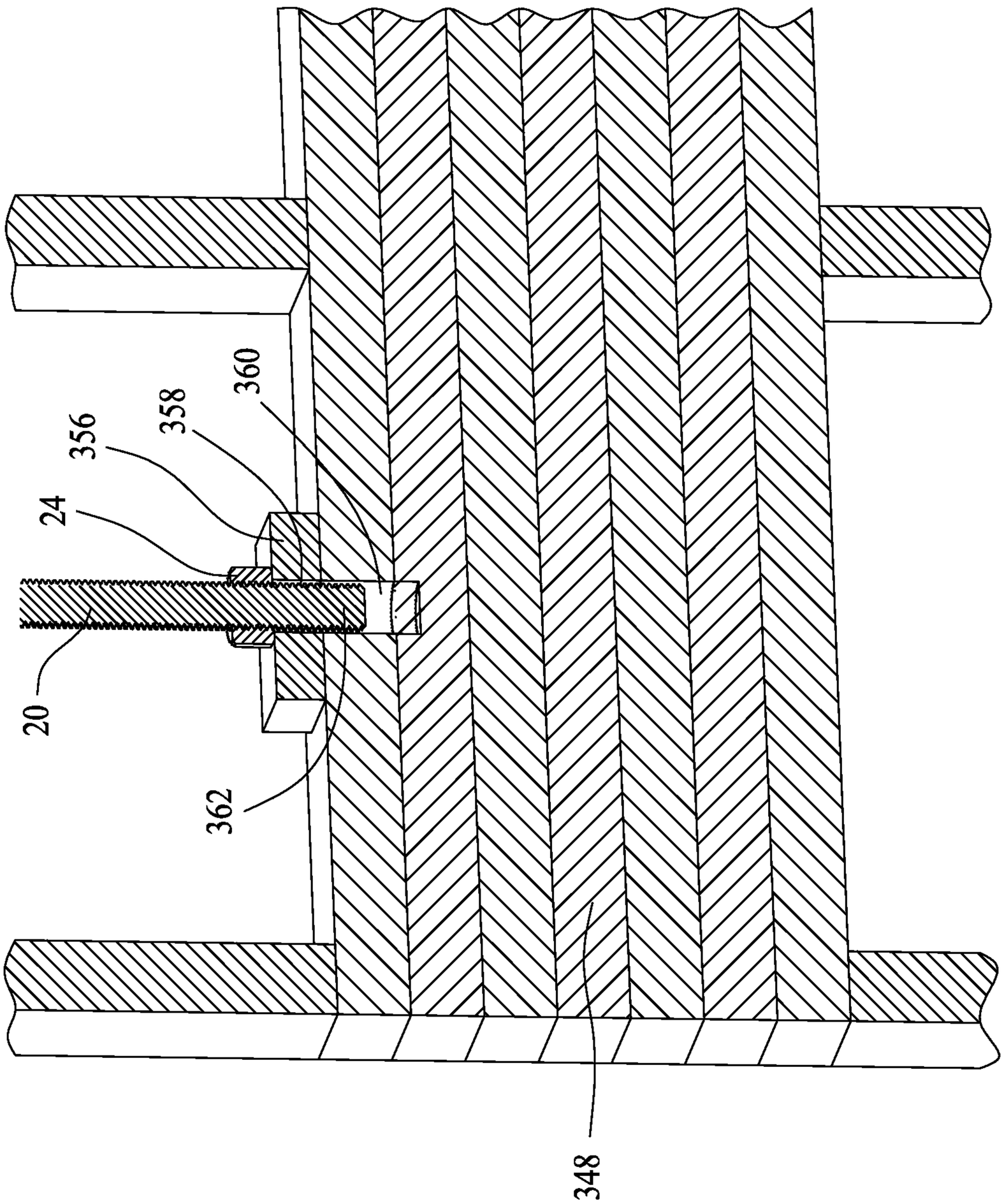


FIG. 180

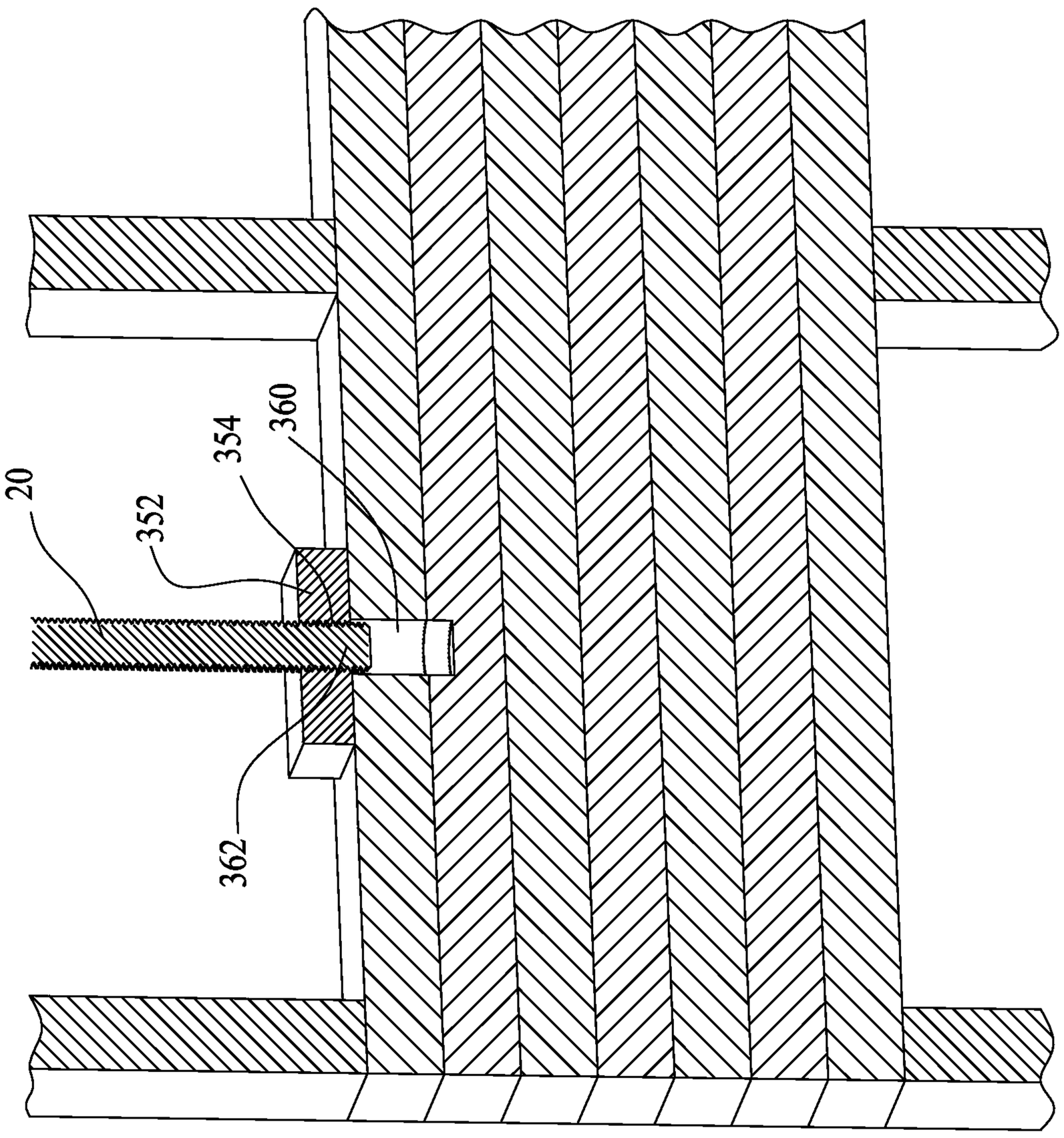


FIG. 181

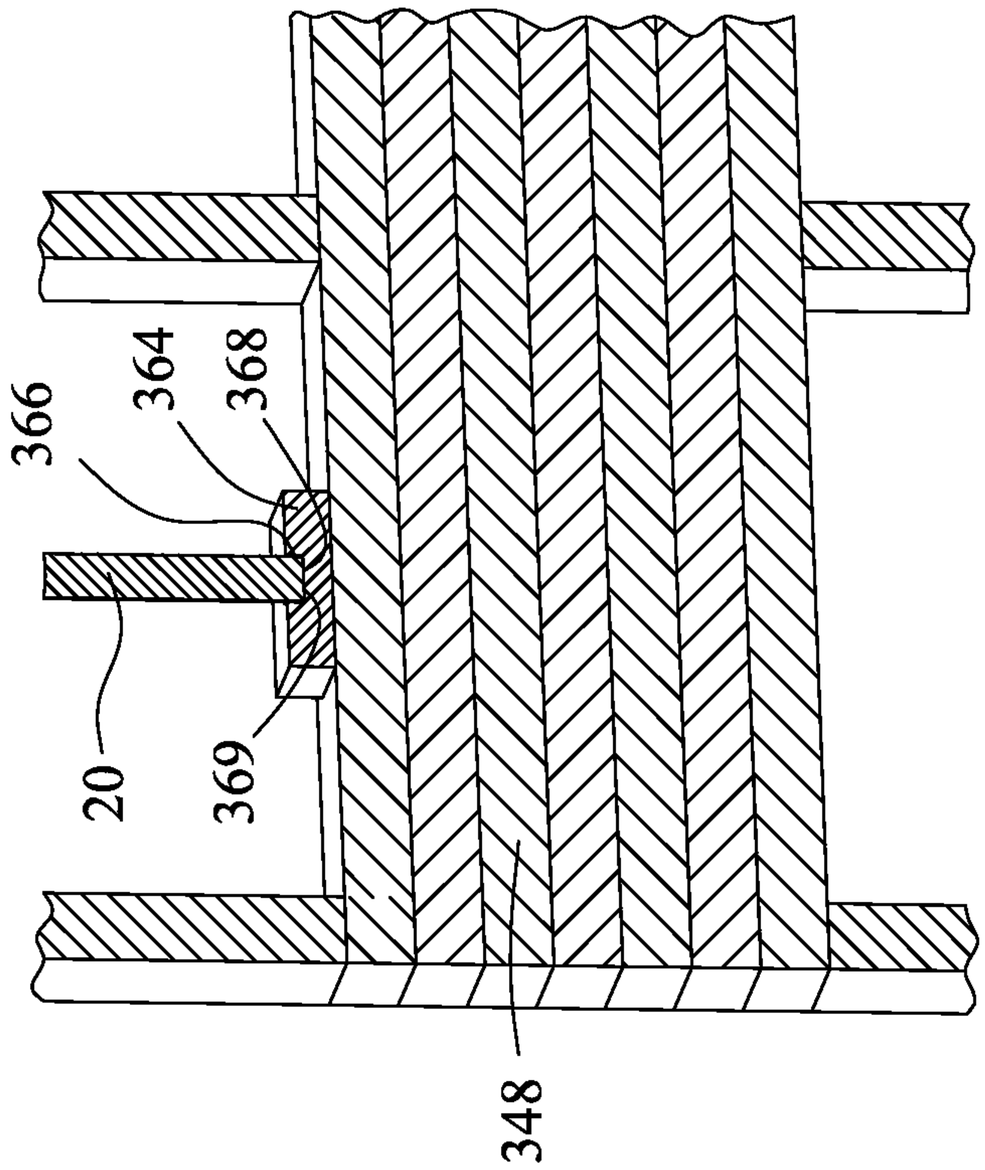


FIG. 183

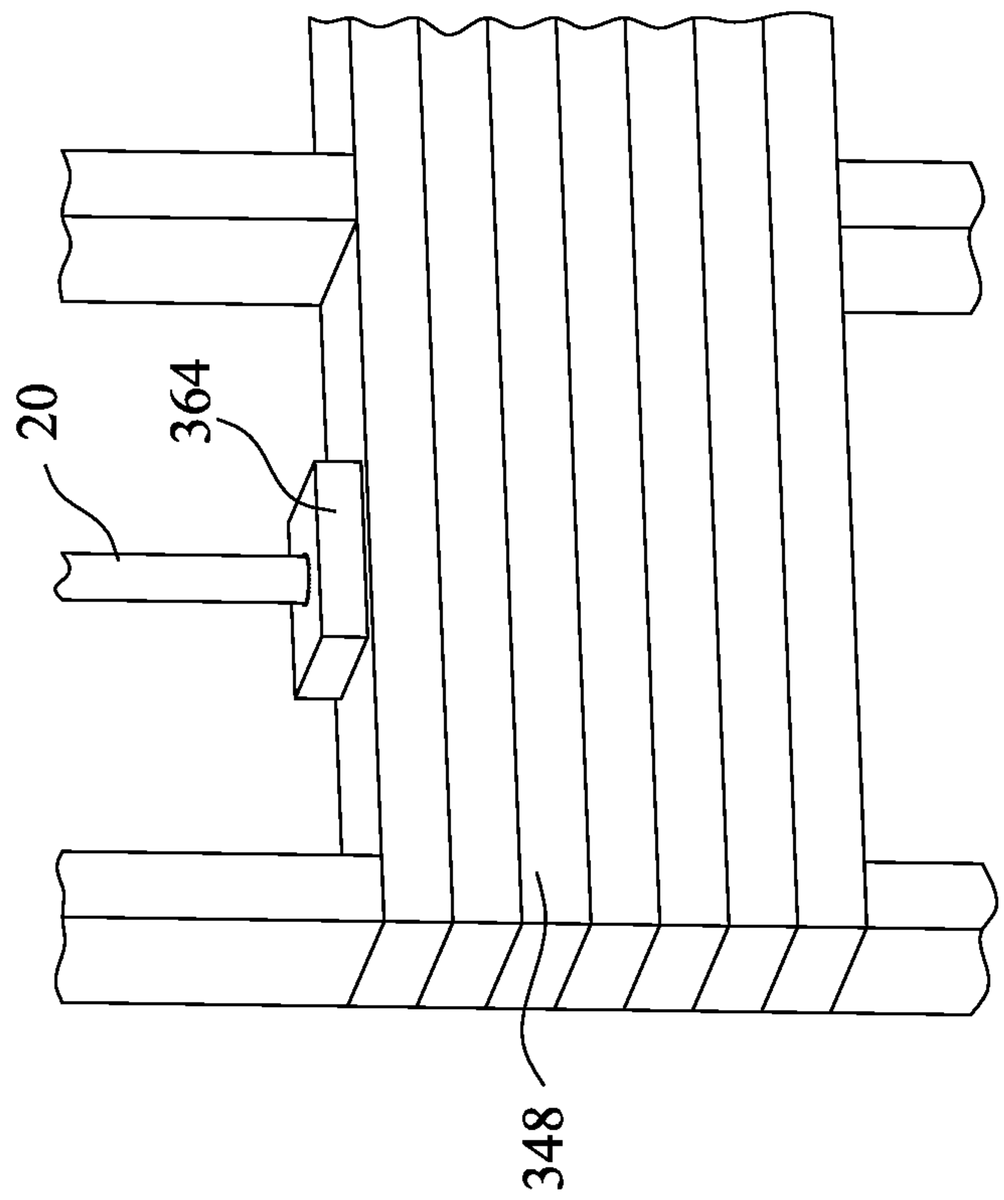


FIG. 182

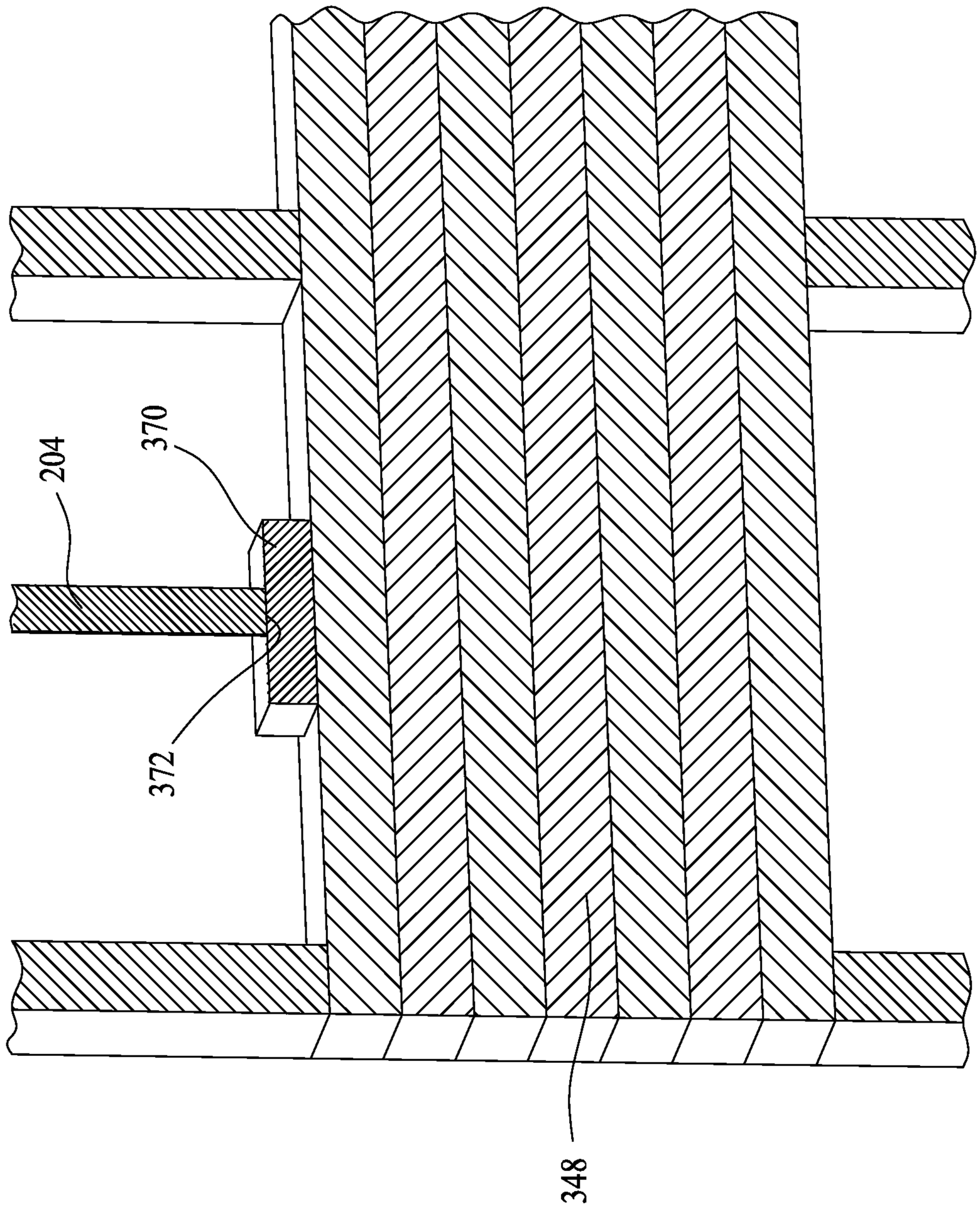


FIG. 184

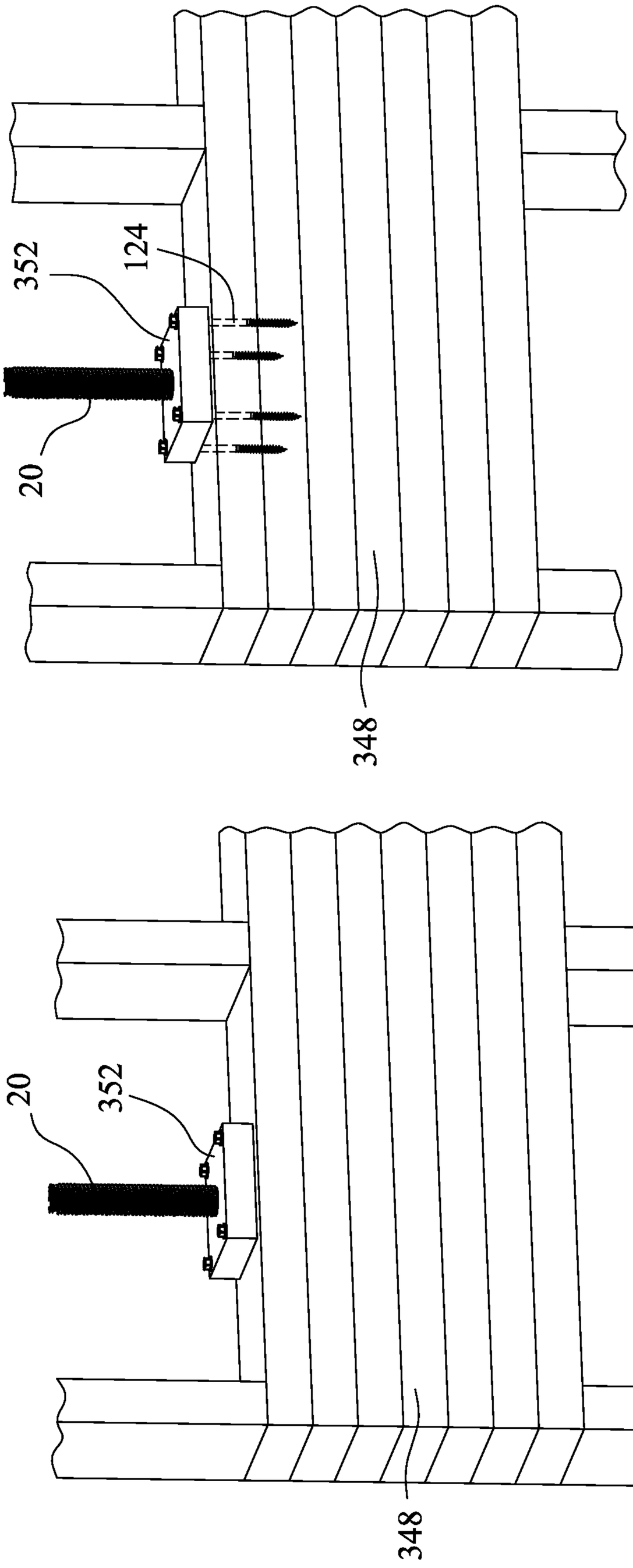


FIG. 186

FIG. 185

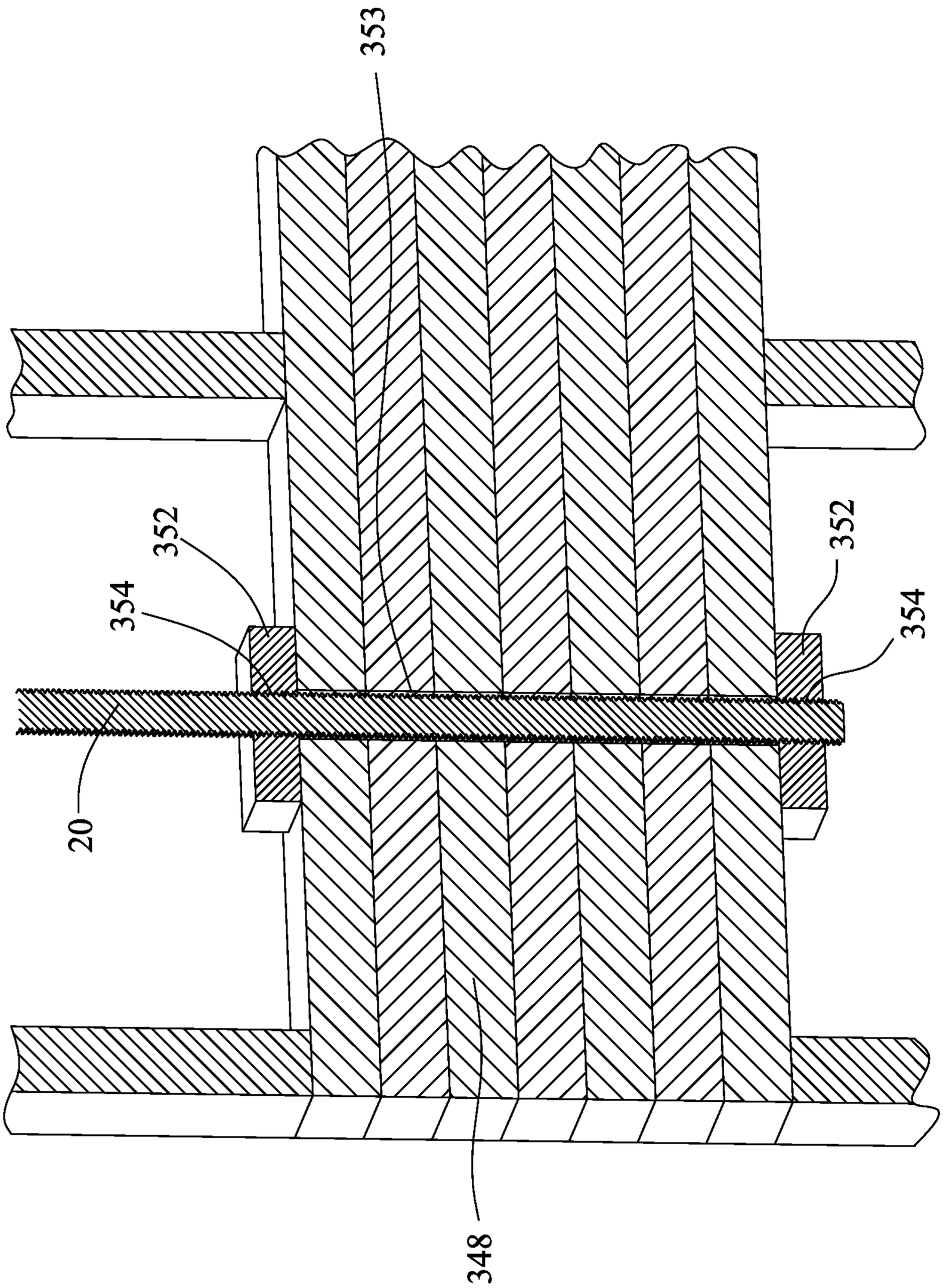


FIG. 187

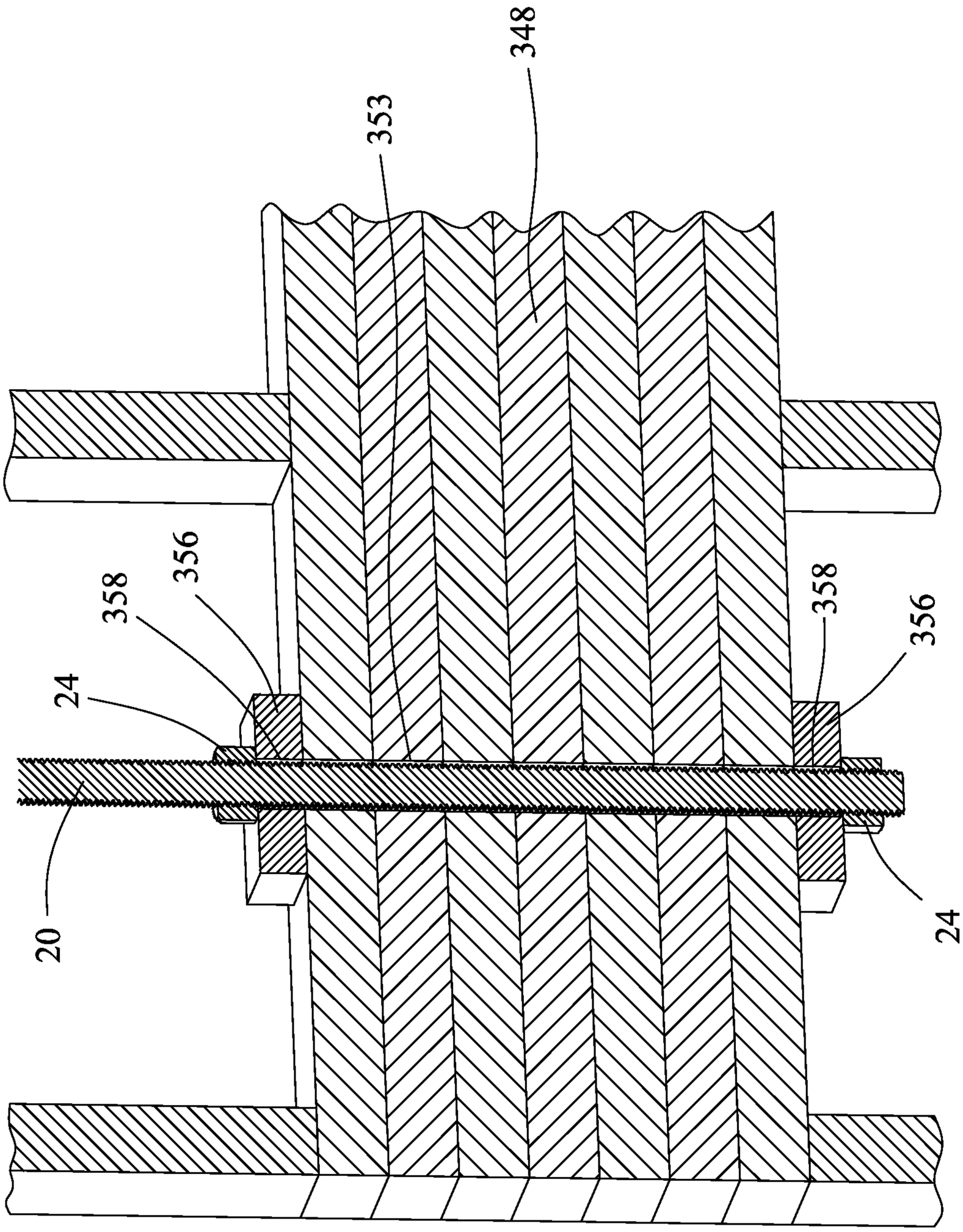


FIG. 188

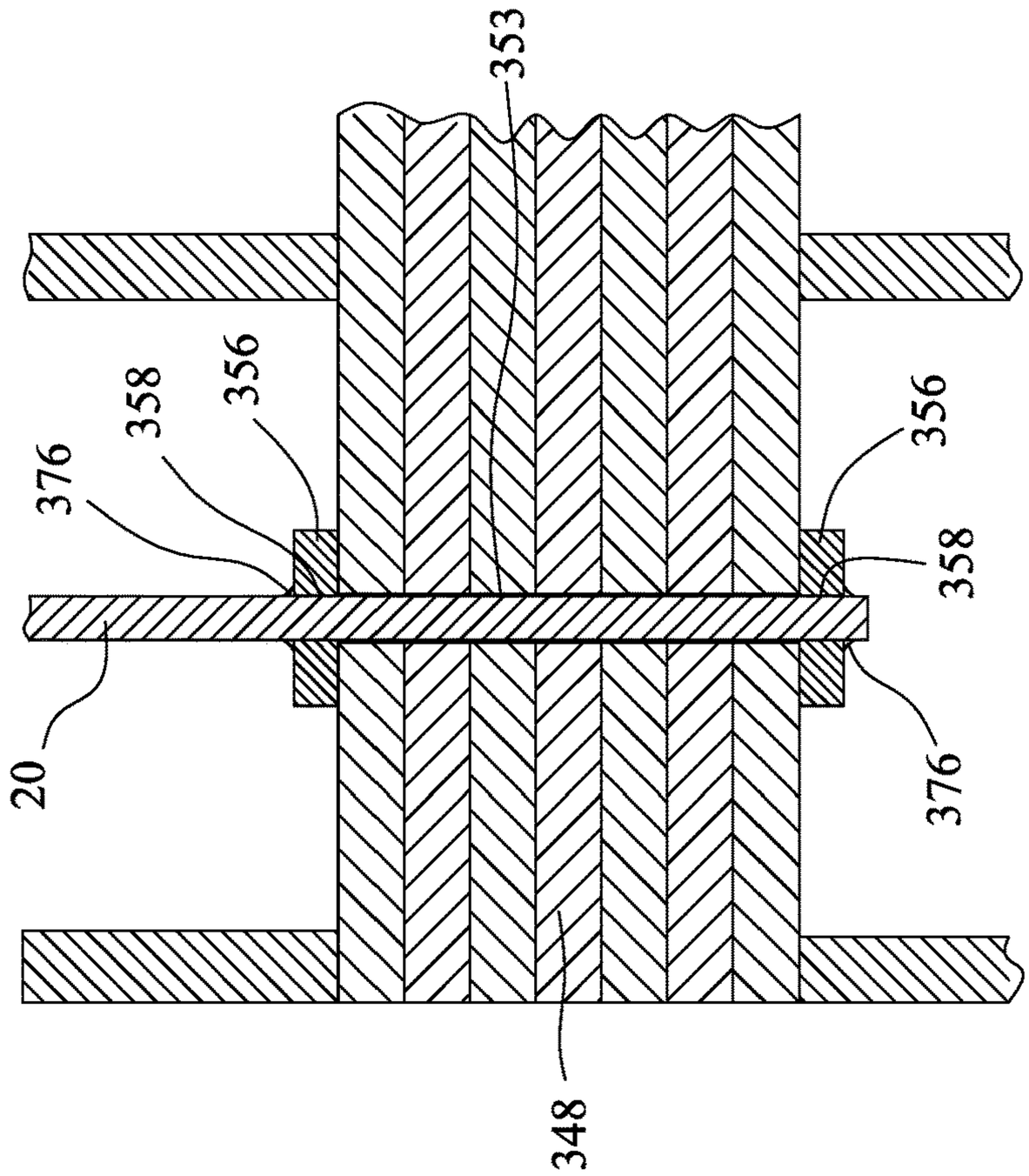


FIG. 190

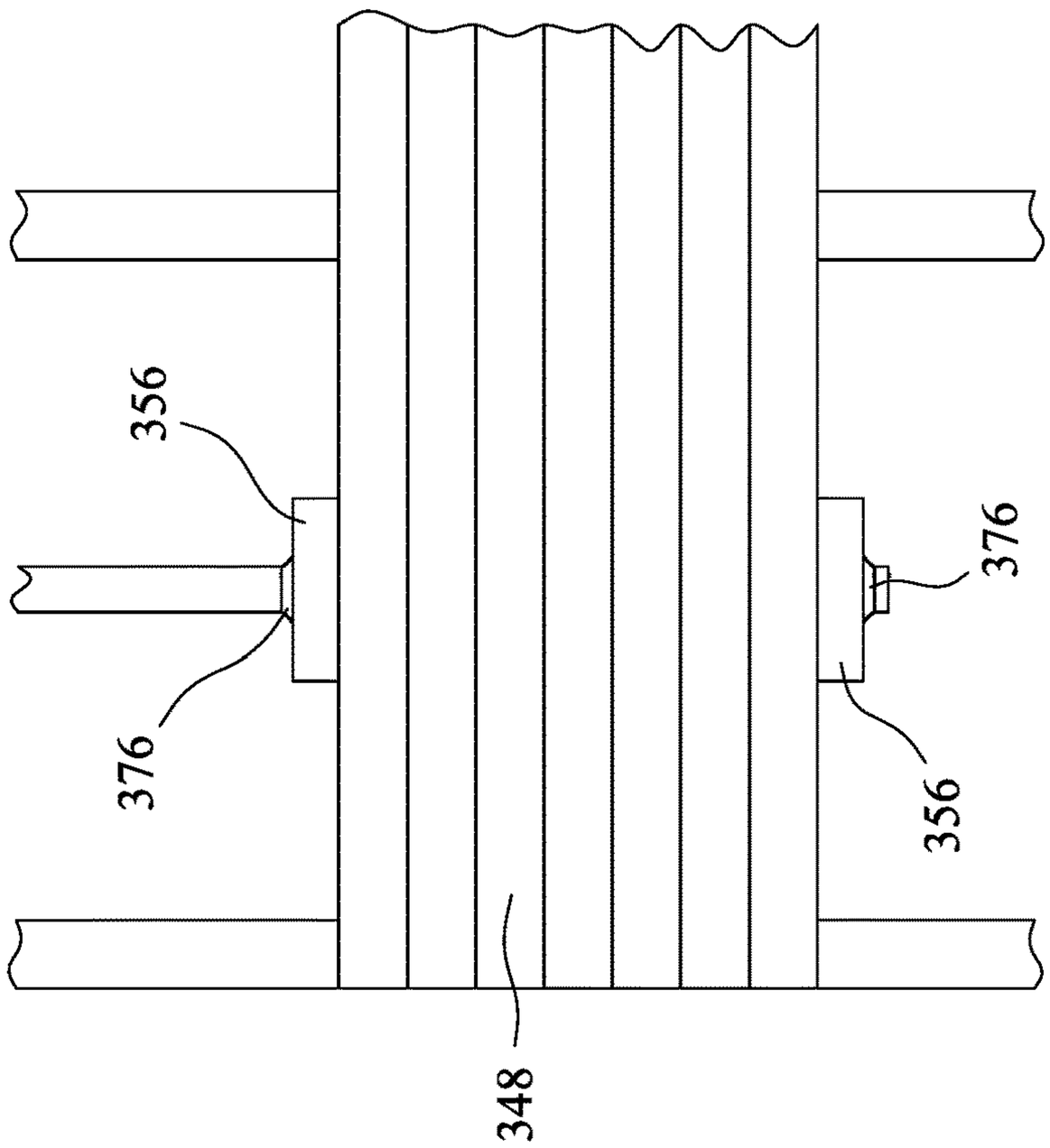
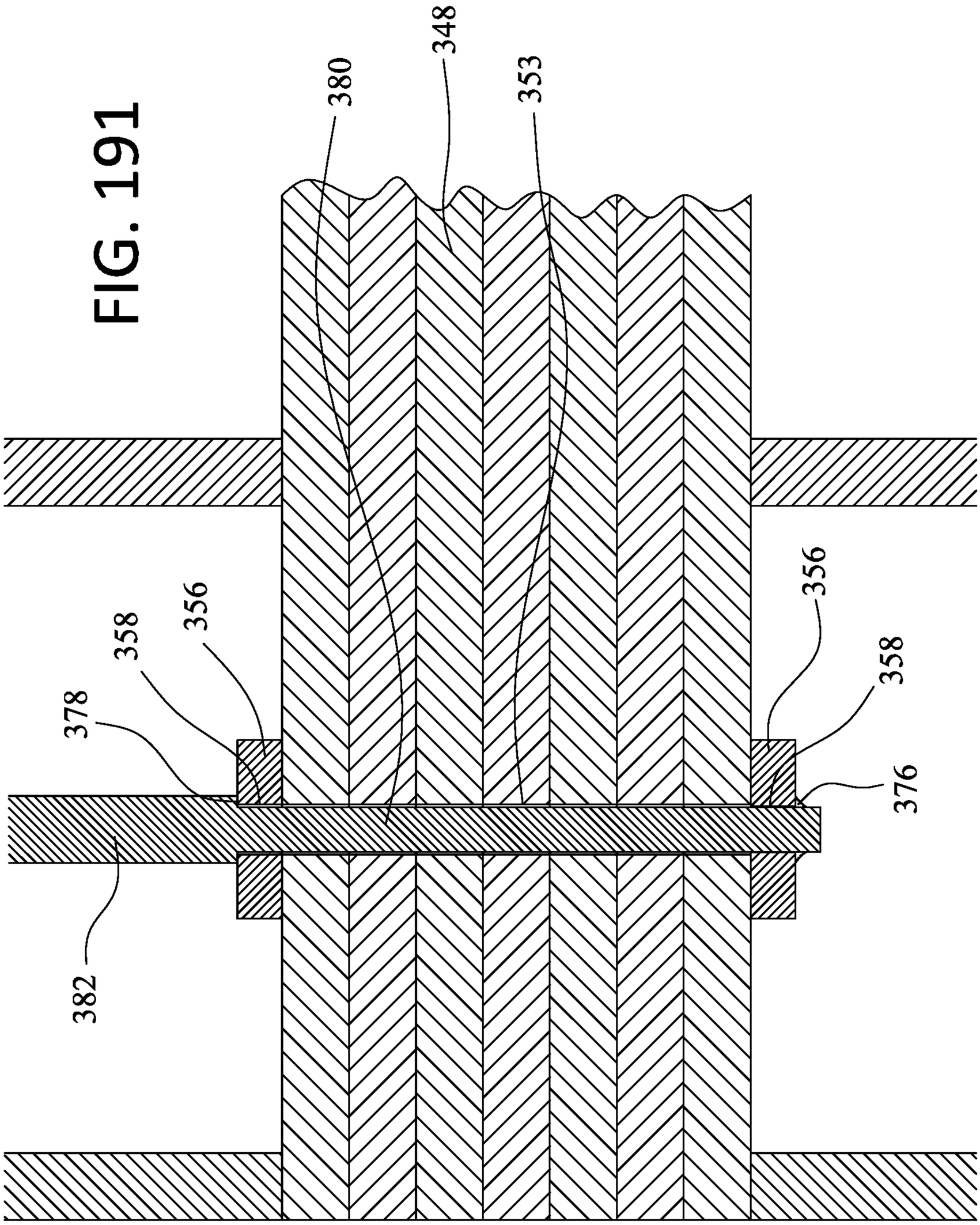


FIG. 189

FIG. 191



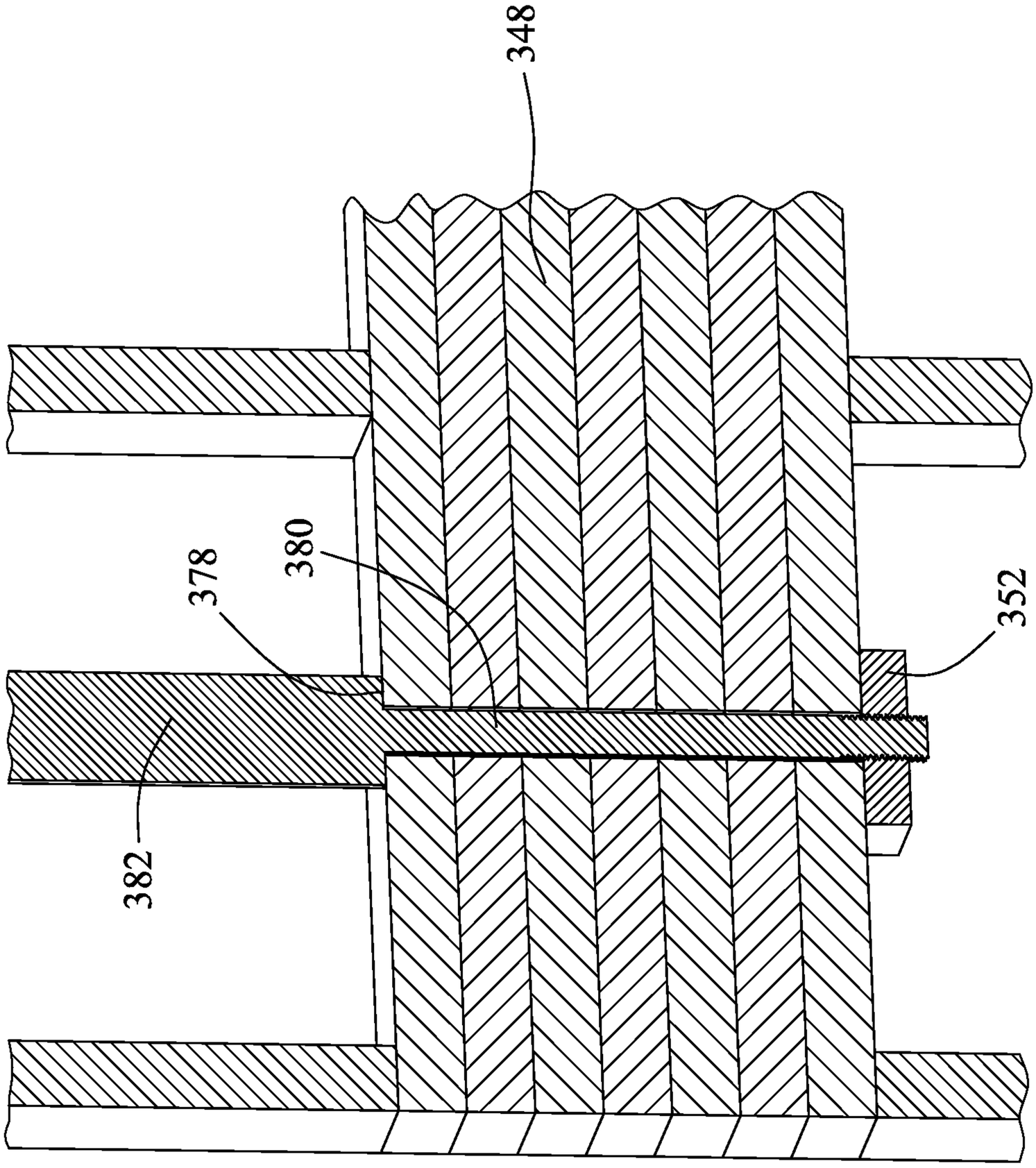


FIG. 192

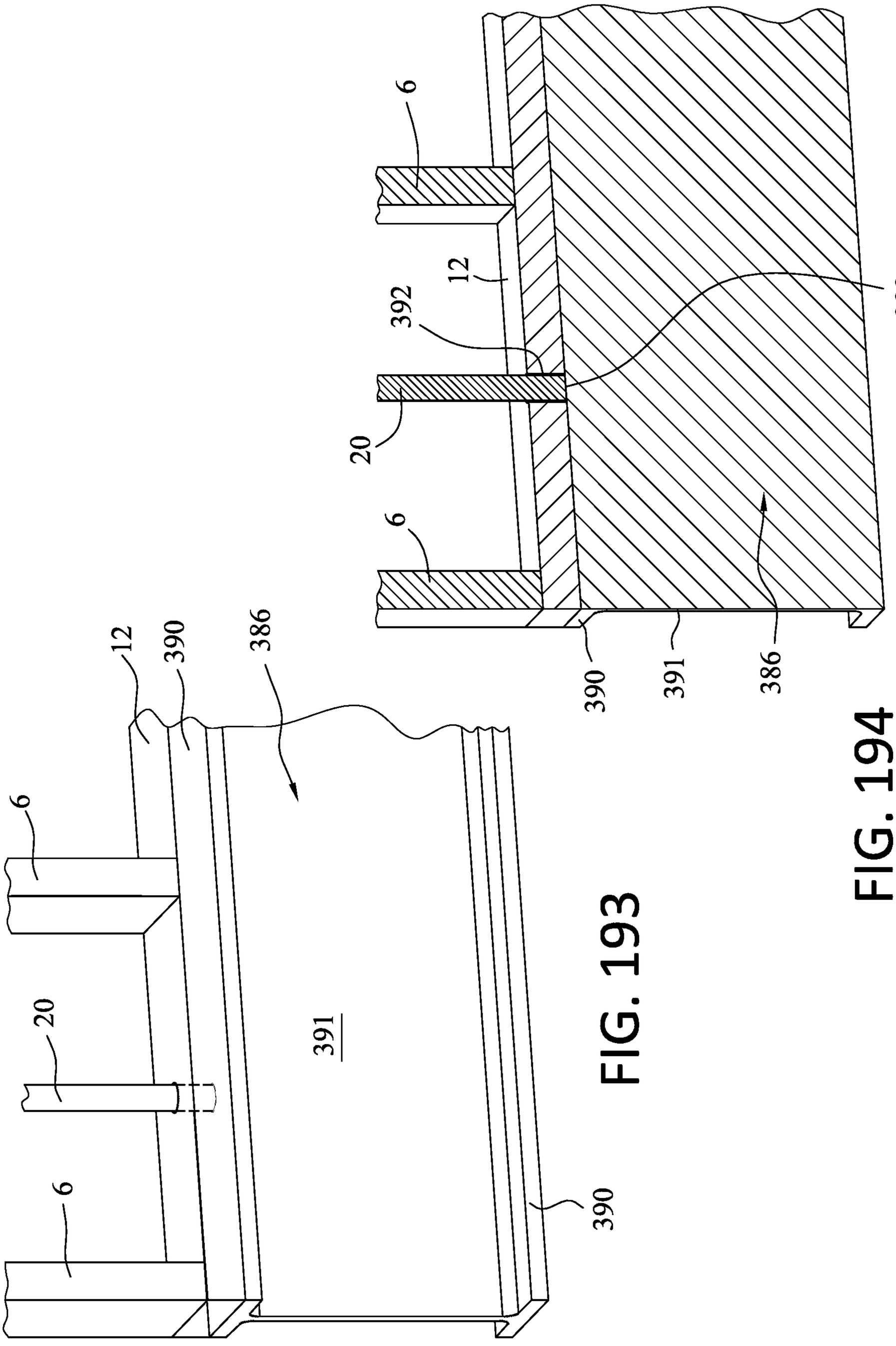


FIG. 193

FIG. 194

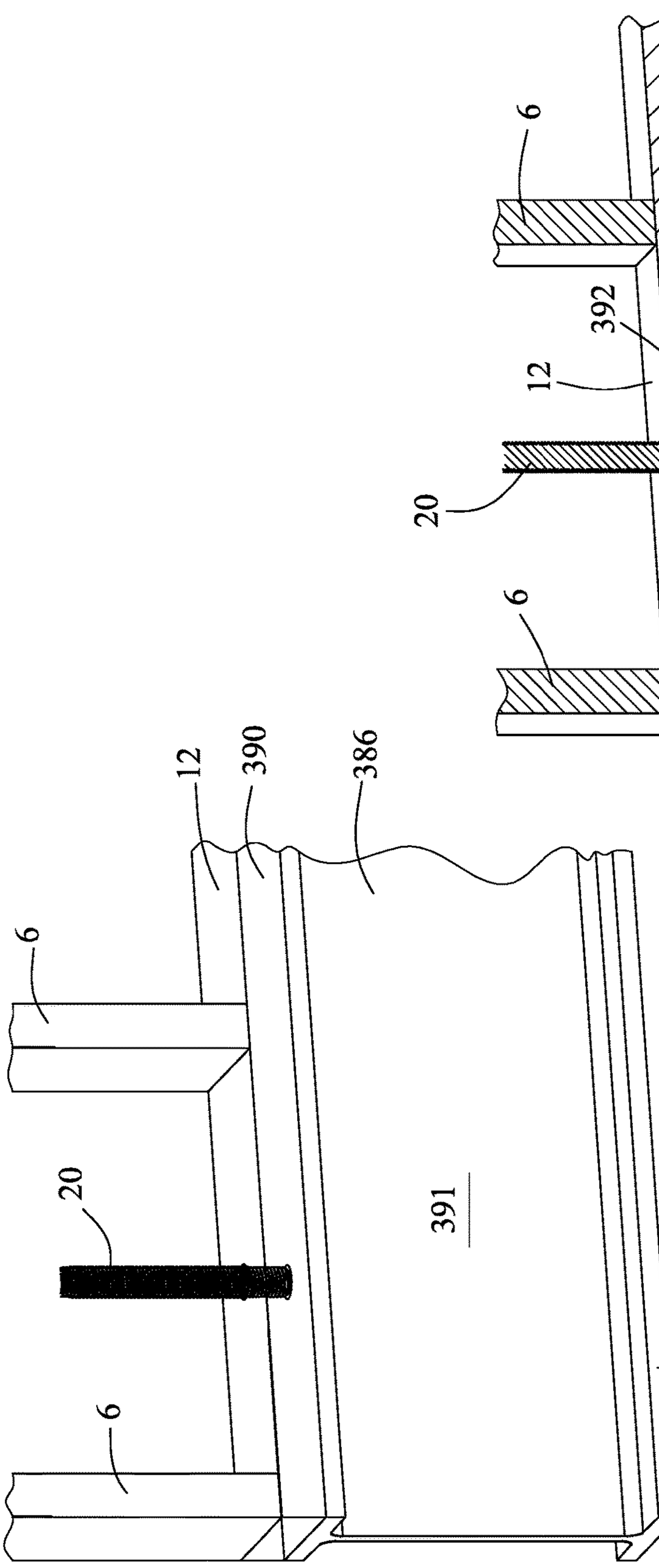


FIG. 195

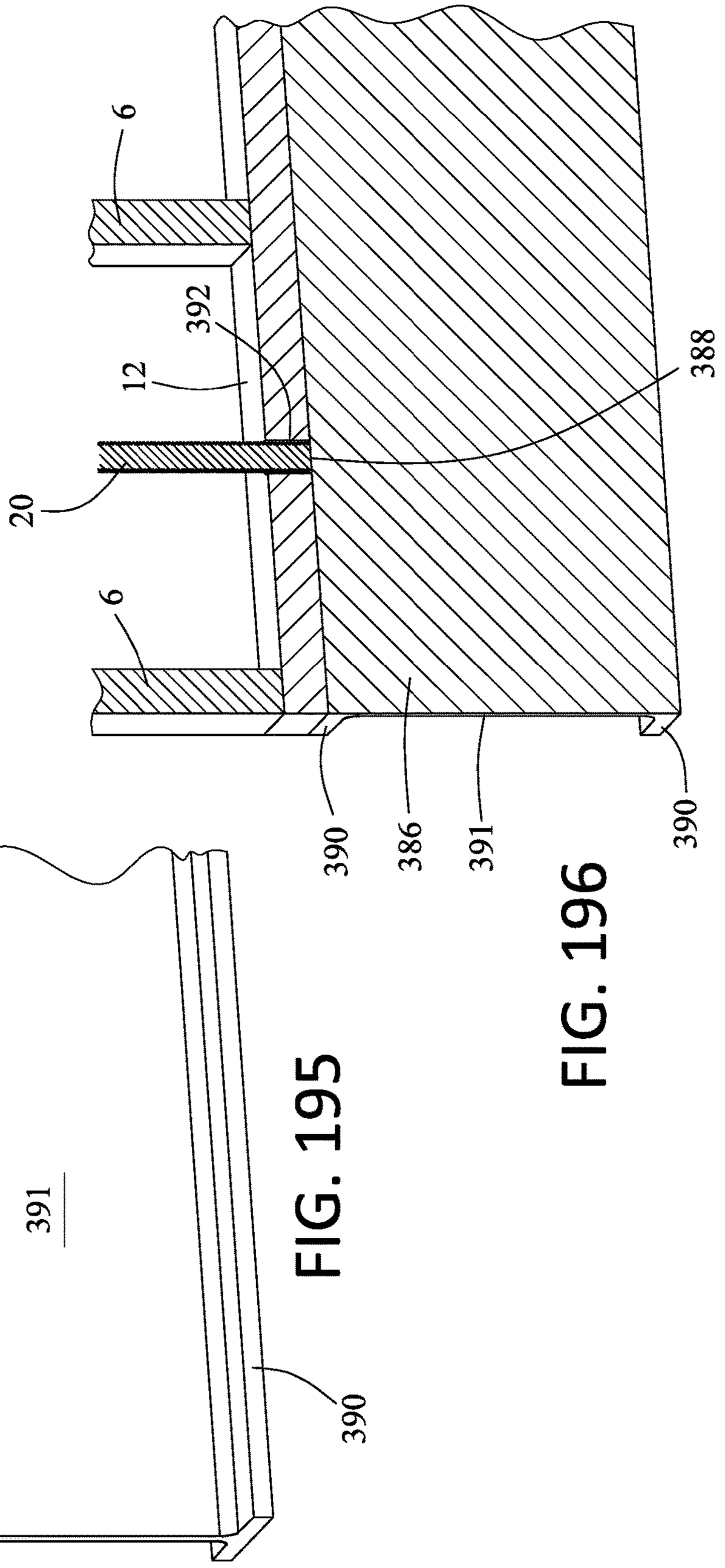


FIG. 196

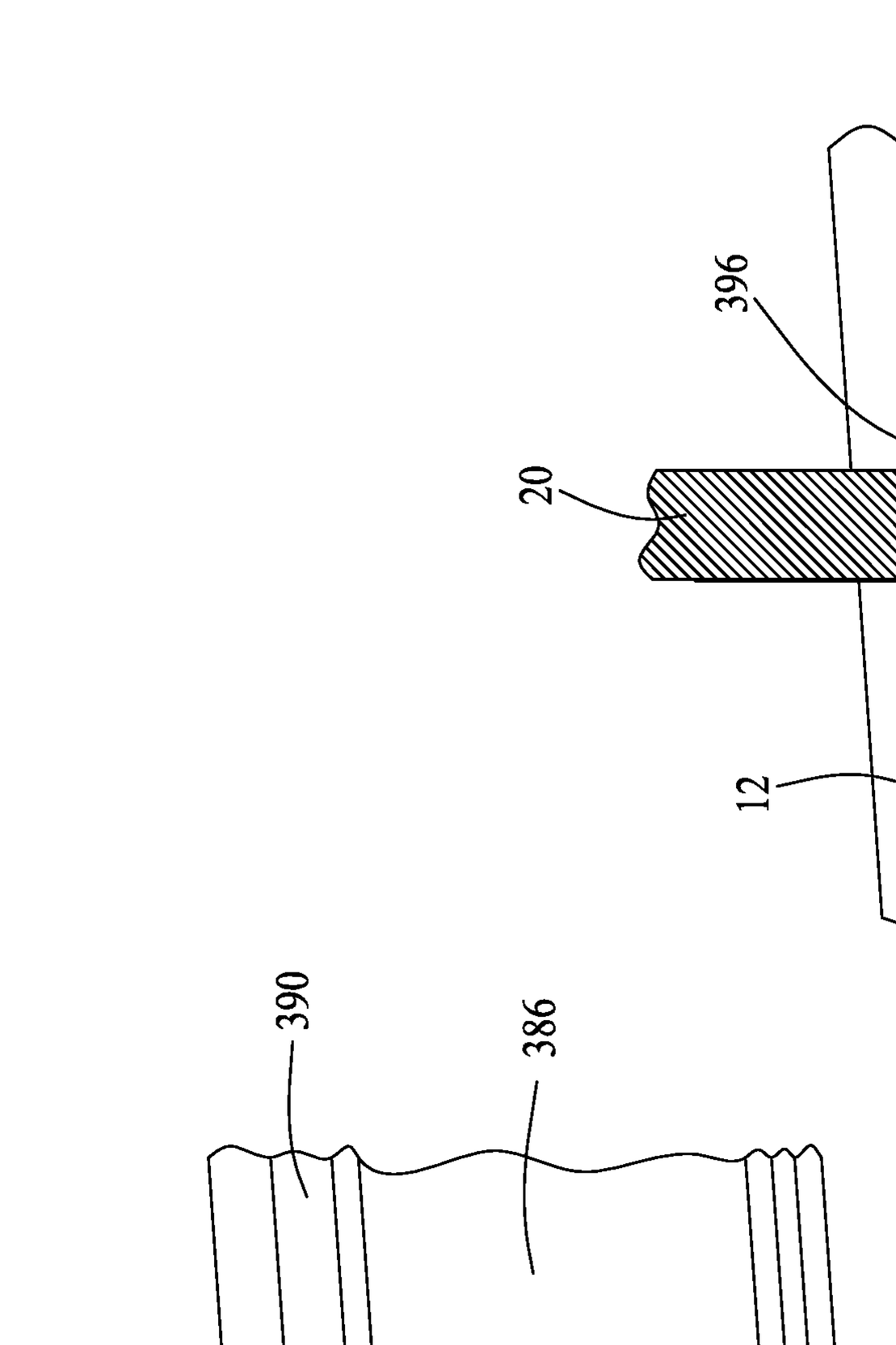


FIG. 198

FIG. 197

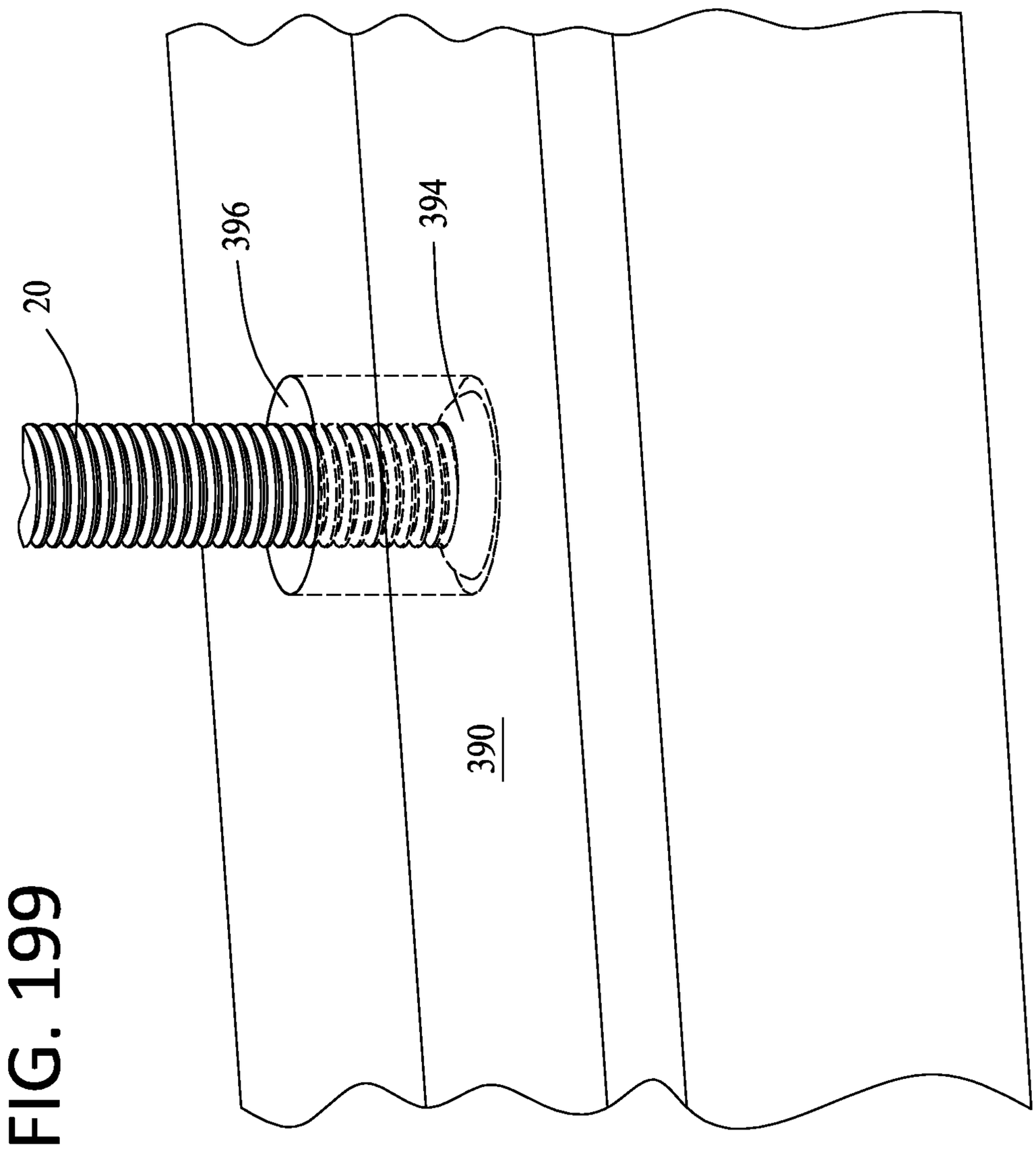


FIG. 199

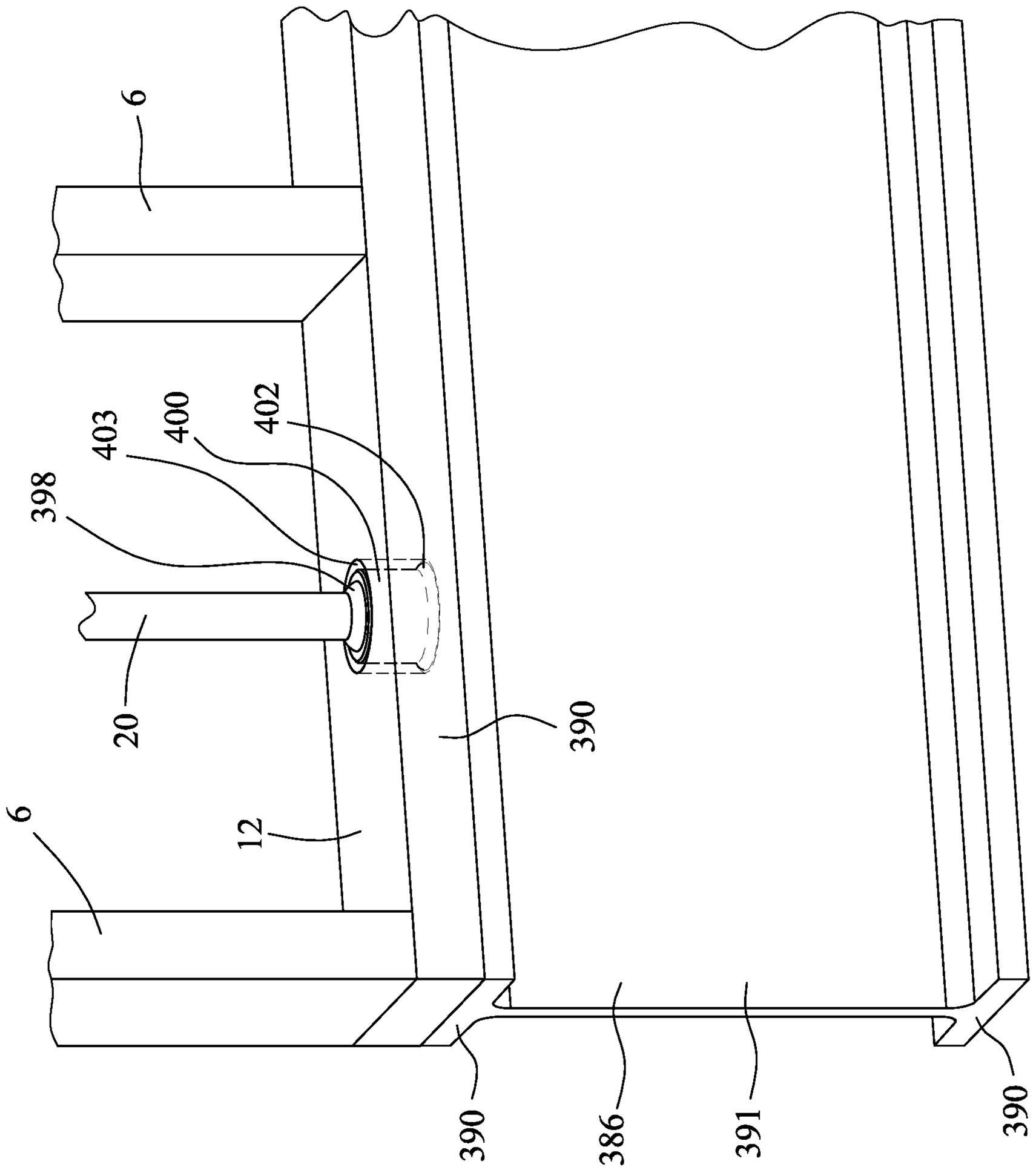


FIG. 200

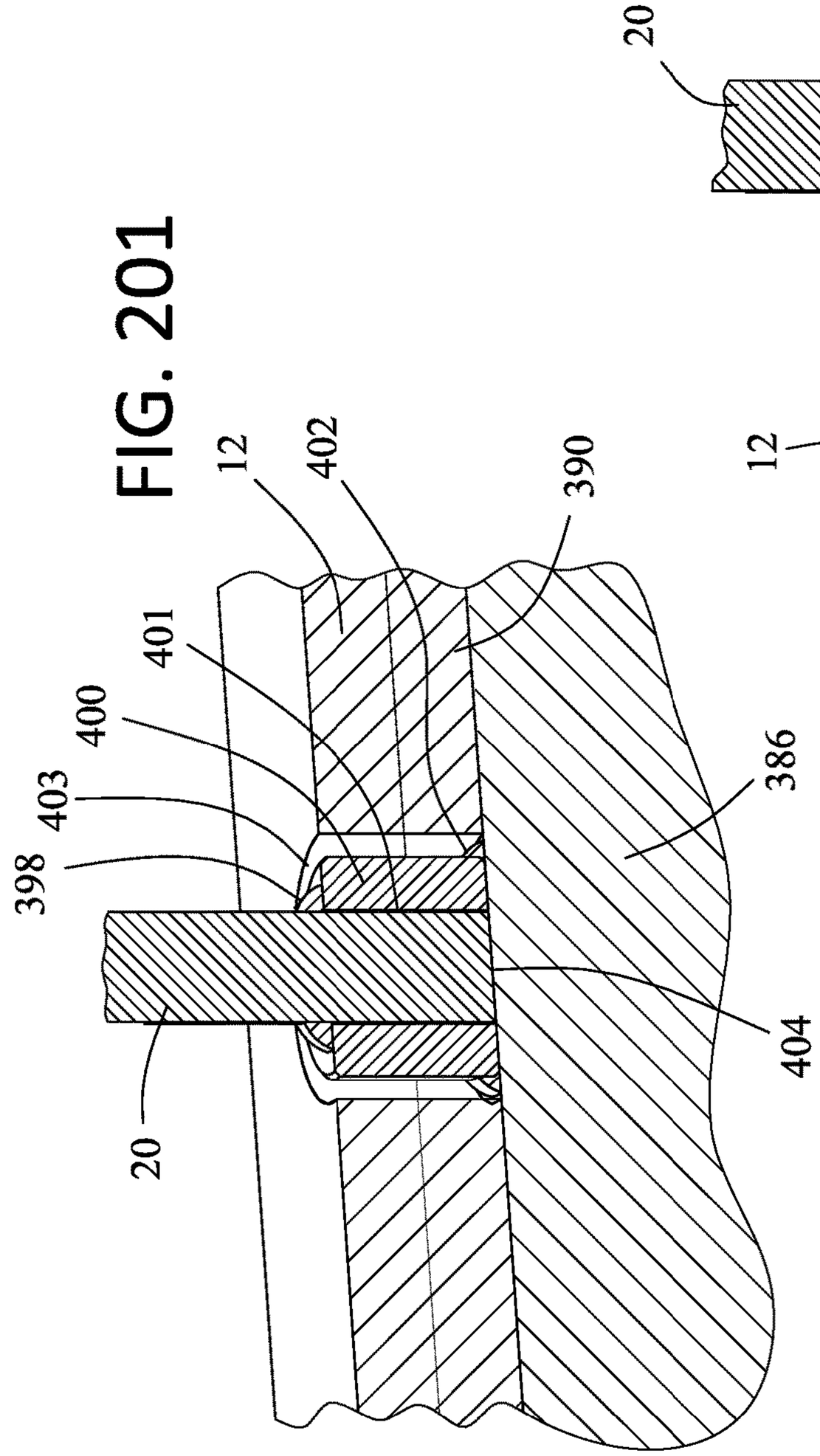


FIG. 201

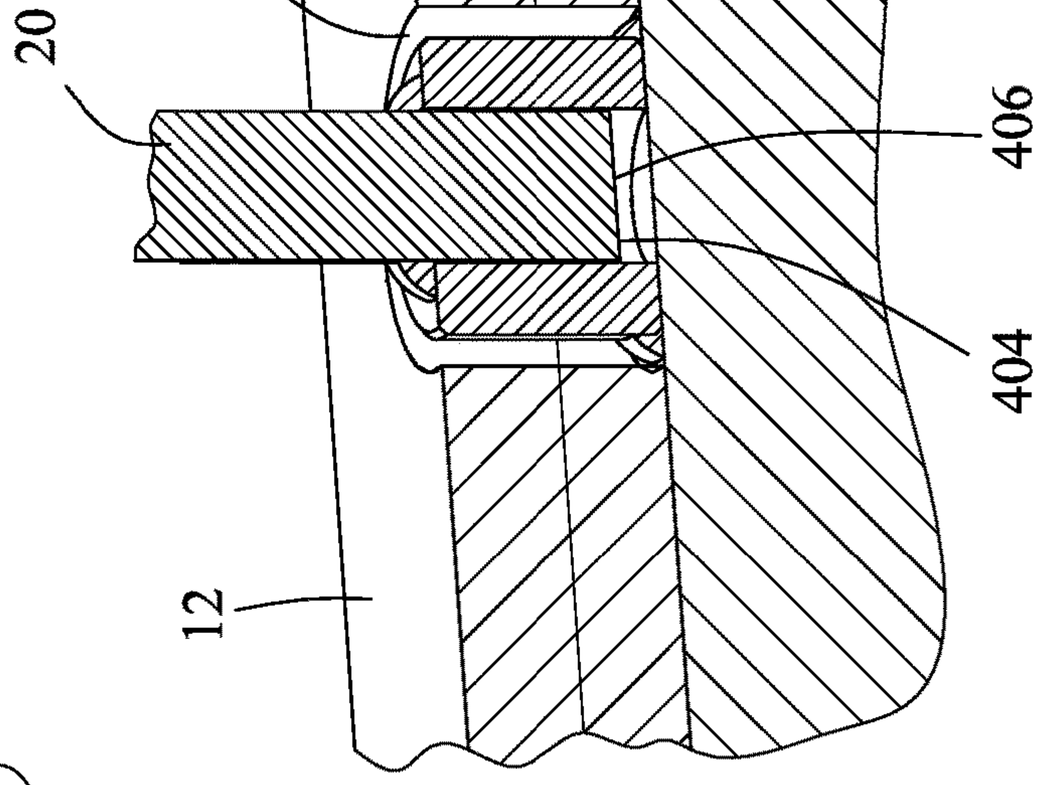


FIG. 202

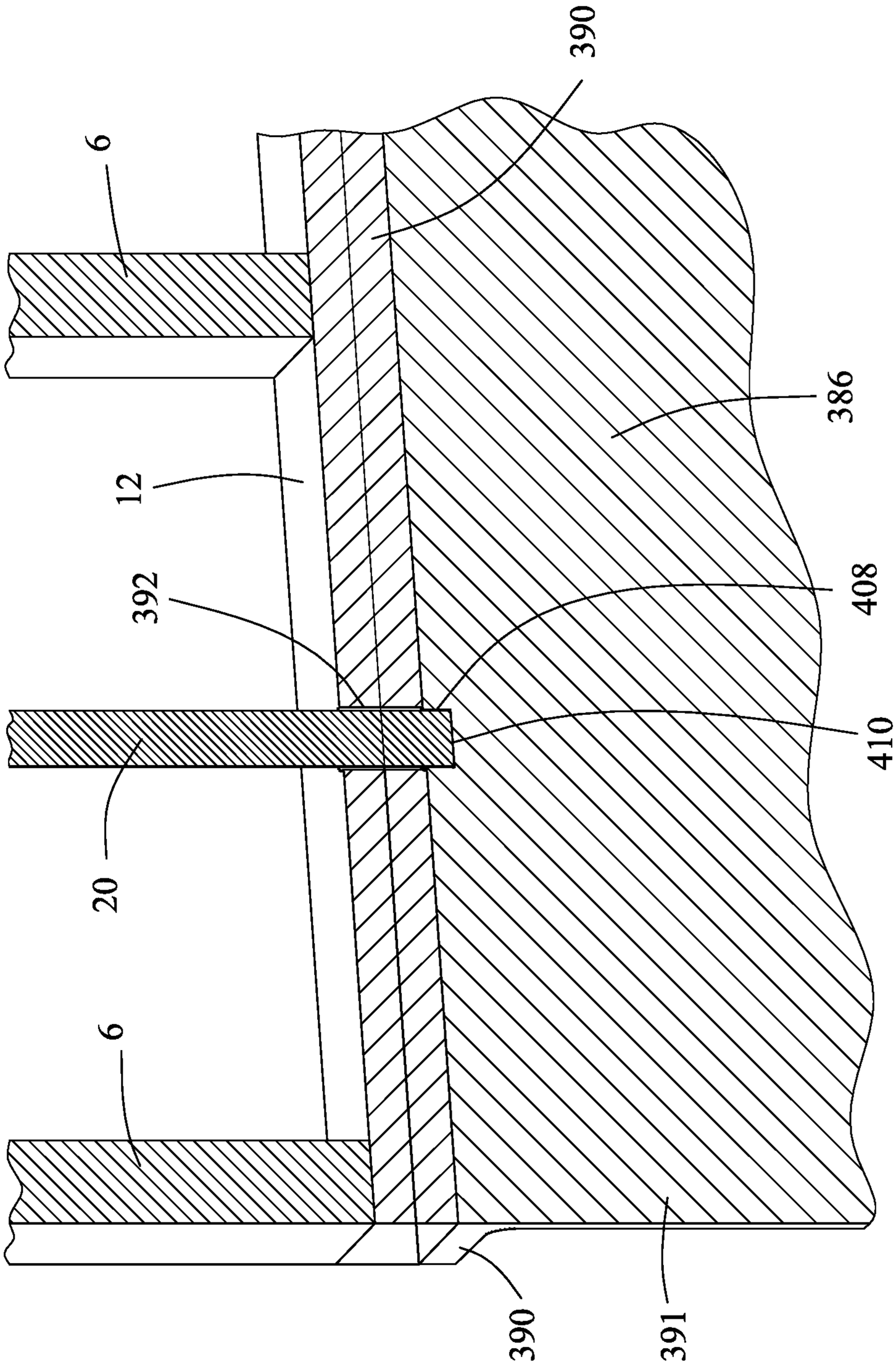


FIG. 203

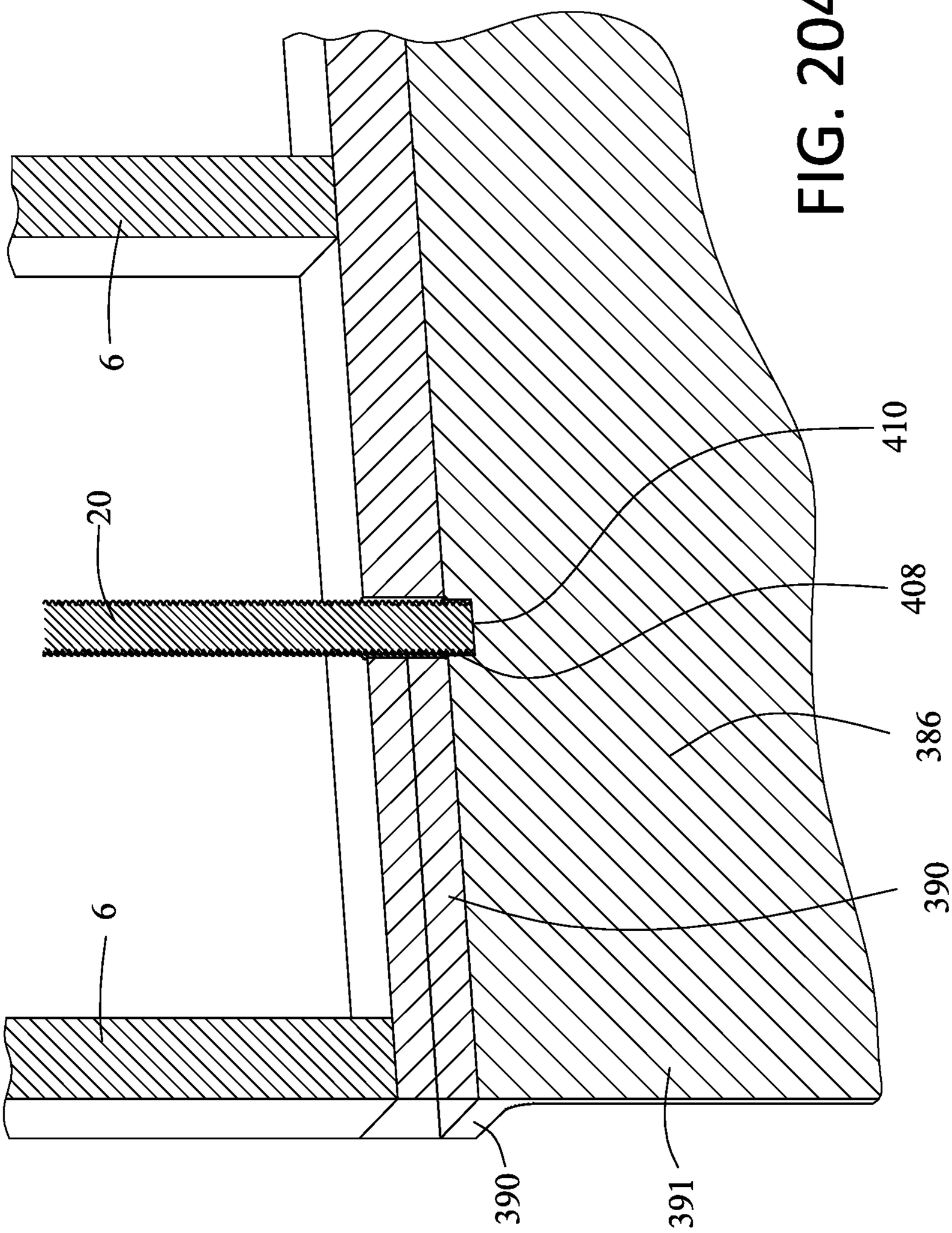


FIG. 204

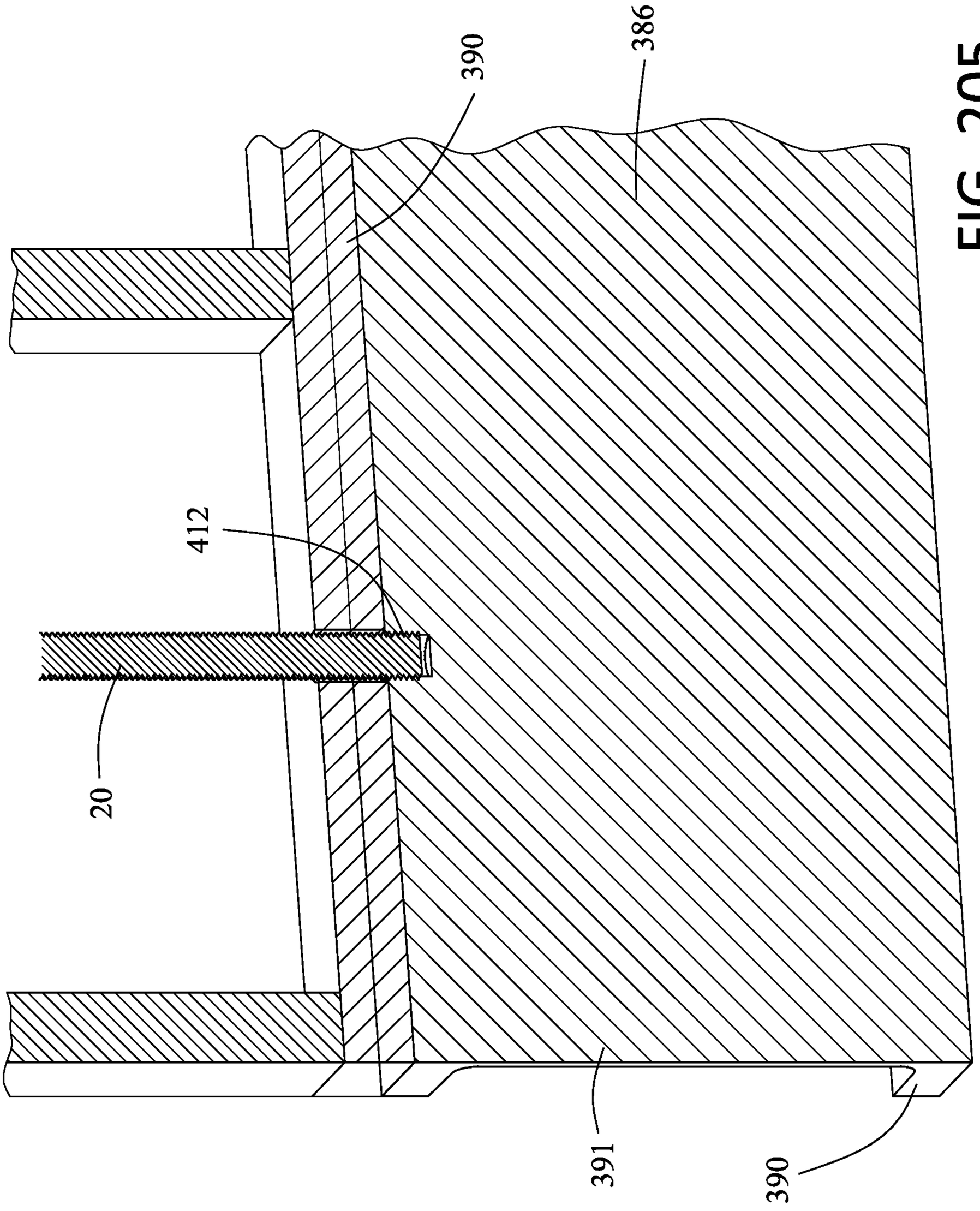


FIG. 205

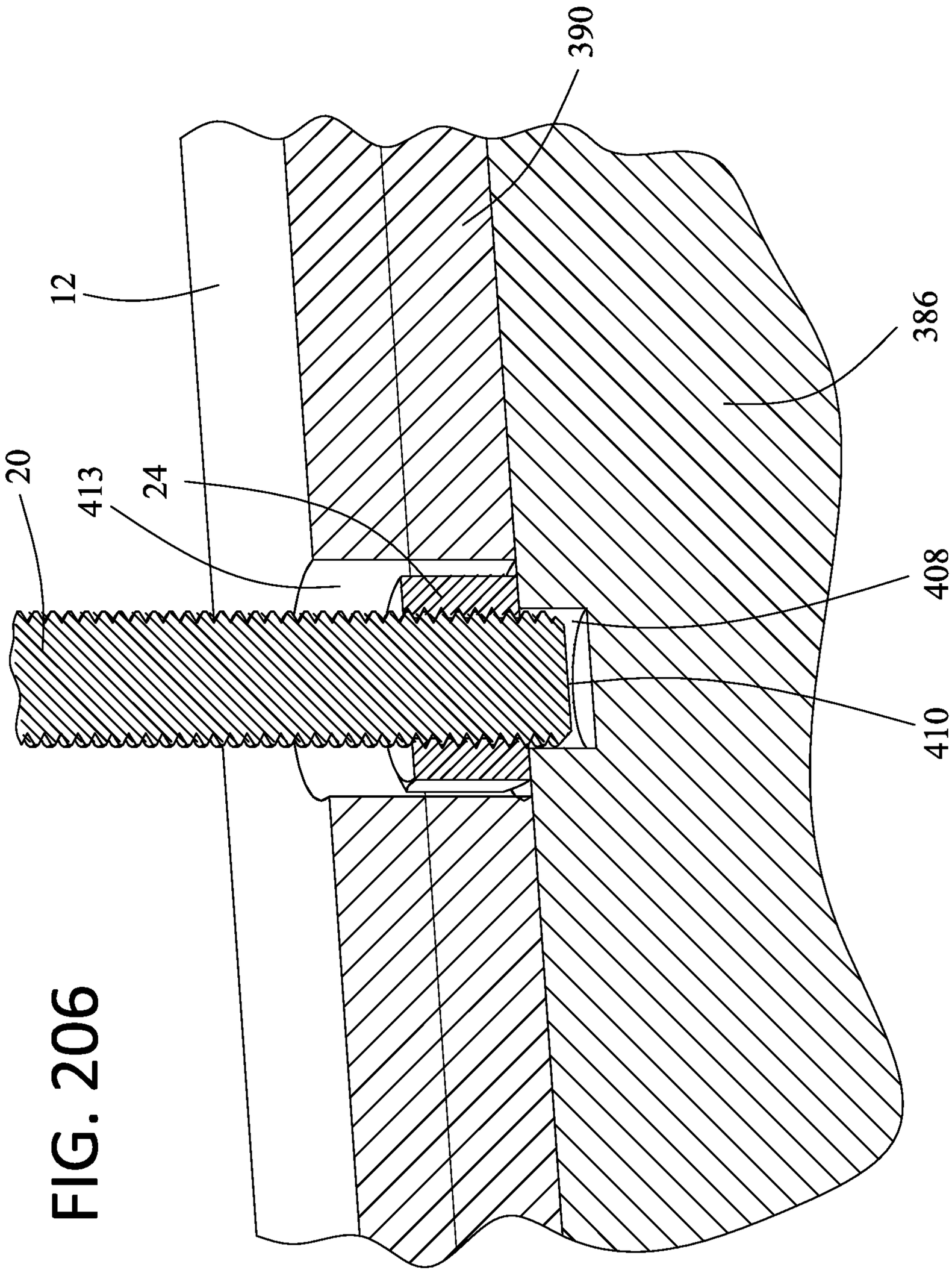
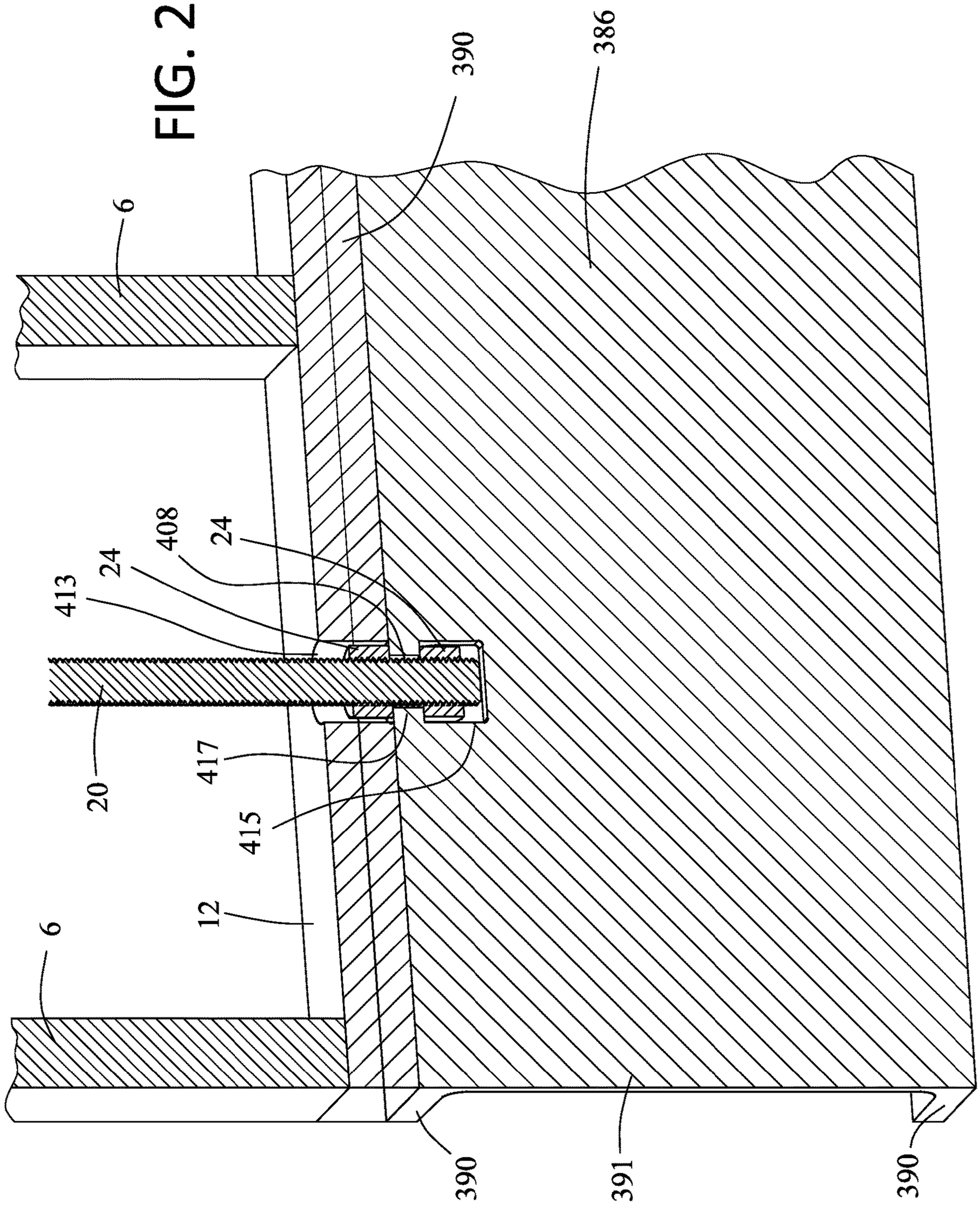


FIG. 206

FIG. 207



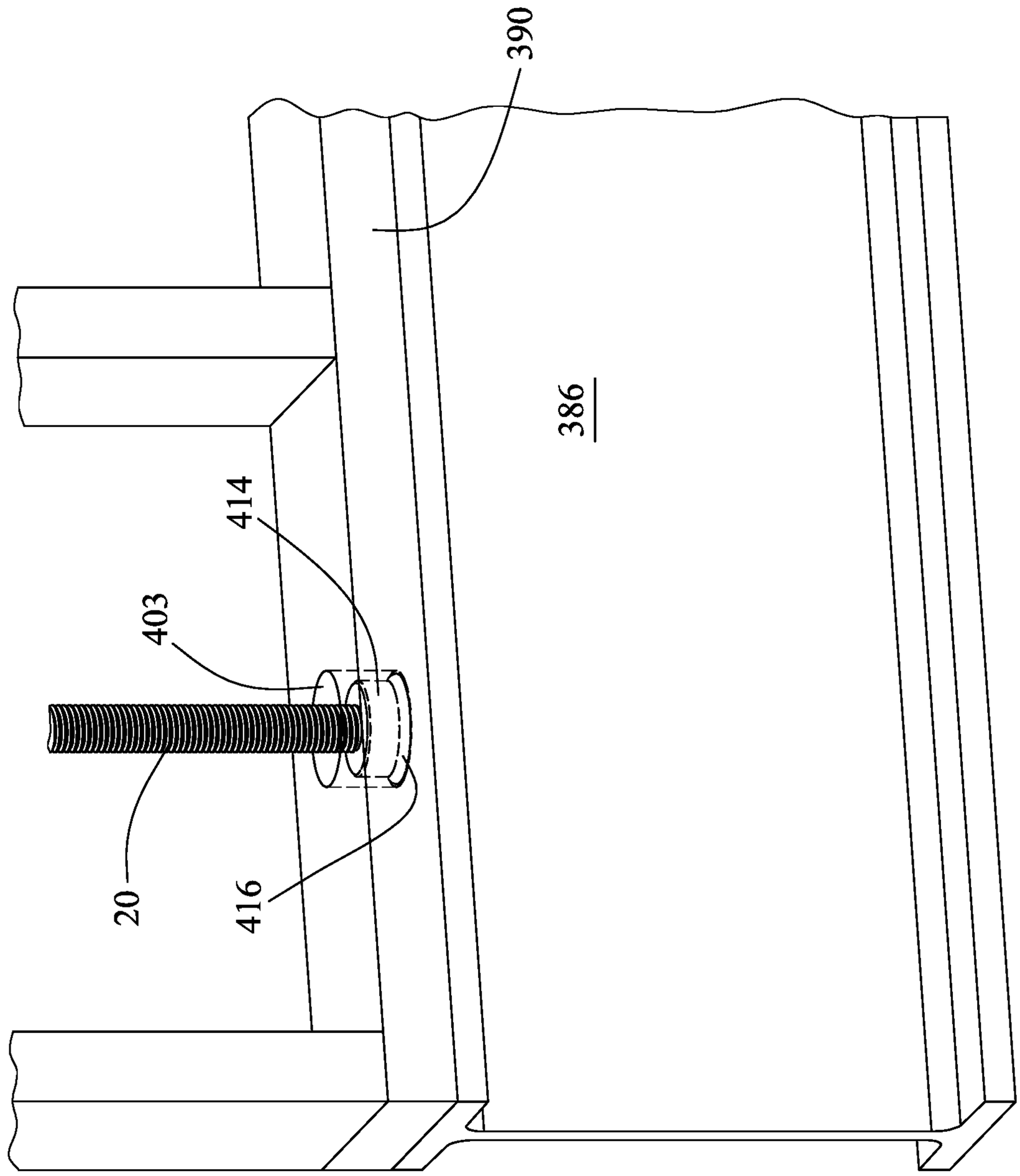


FIG. 208

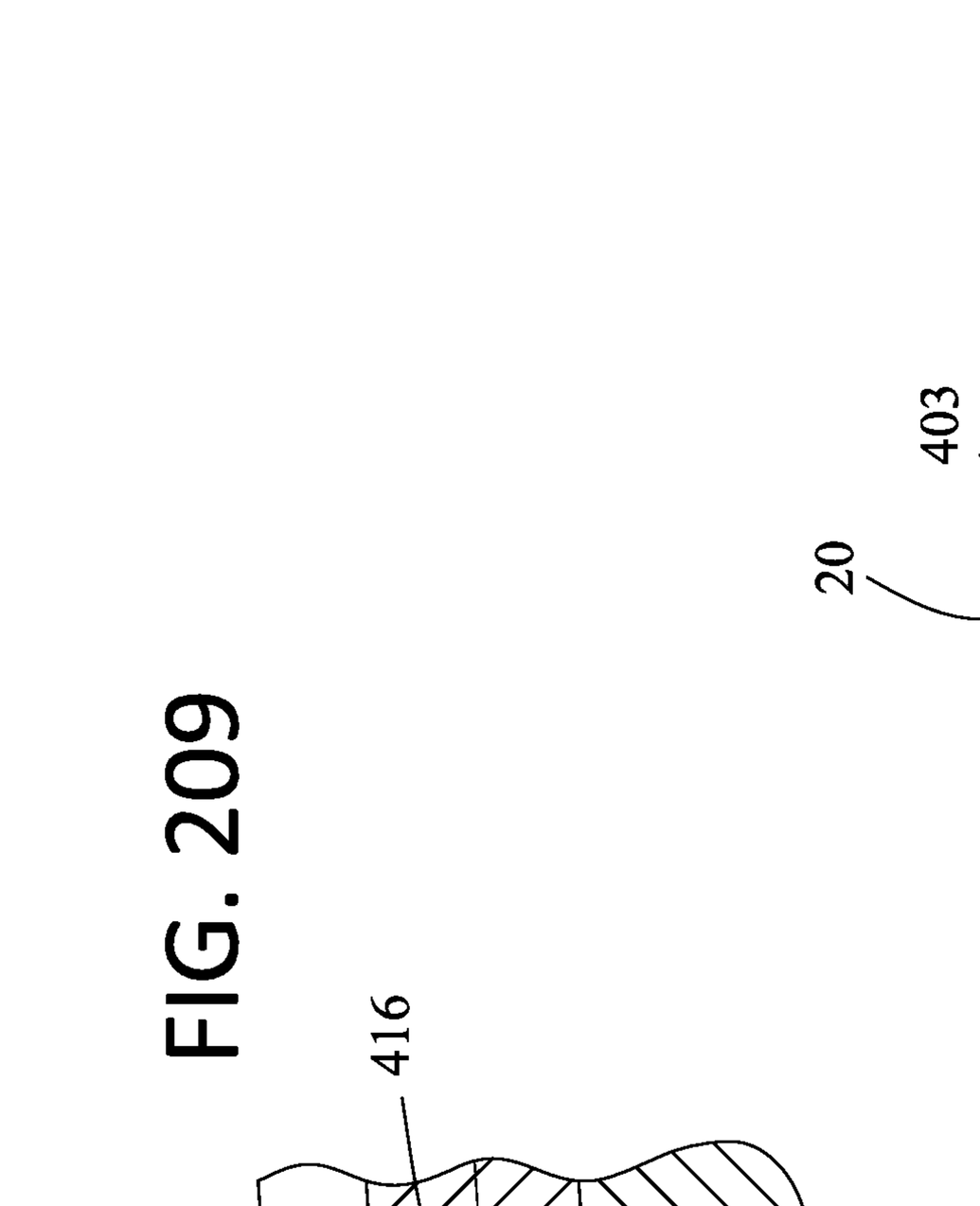


FIG. 209

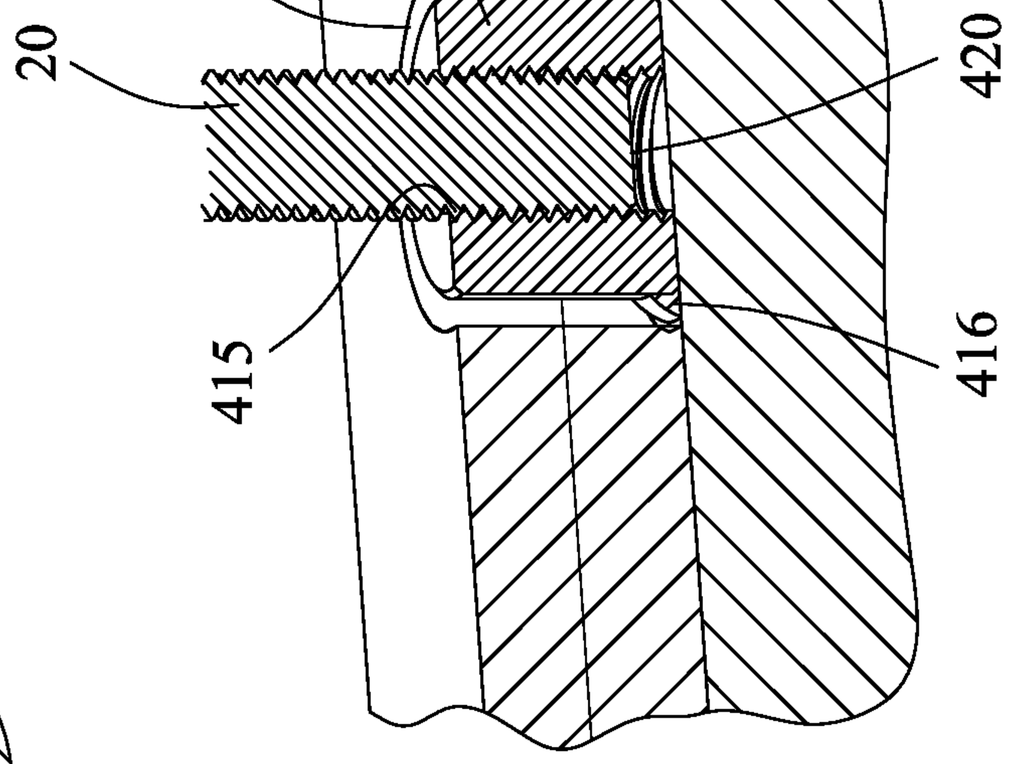


FIG. 210

COMPRESSION AND TENSION REINFORCED WALL

RELATED APPLICATION

This is a divisional application of Nonprovisional application Ser. No. 16/415,595, filed May 17, 2019, claiming the priority benefit of Provisional Application Ser. No. 62/672,809, filed May 17, 2018, both applications being hereby incorporated herein by reference.

FIELD OF THE INVENTION

The present invention is generally directed to reinforced building walls designed to resist static and dynamic compression and tension forces.

BACKGROUND OF THE INVENTION

Reinforced building walls using threaded rods anchored to the foundation are disclosed in the prior art. For example, see U56951078, U57762030, U58136318, U.S. Pat. No. 8,943,777, U59097000, U59097001, U59416530 and U59874009, hereby incorporated herein by reference. These walls are designed to hold the walls against tension loads or forces caused by earthquakes and/or high winds.

SUMMARY OF THE INVENTION

The present invention discloses the use of rods as posts in building wall to transfer compression loads to the foundation. The present invention advantageously reduces the amount of material used in shear walls. The present invention uses rods anchored to the foundation as posts, allowing compression forces to be shifted from the framing members to the rods, thereby reducing the number of framing members to carry the same load.

Compression forces are both static and dynamic. Static compression comes from weight of the wall above. Dynamic compression comes from added load when one corner of a shear wall is lifted, shifting load to the opposite corner. Load on the wall comes from downward force in a particular place of the building, wood beam load, etc. Short term duration loading comes from earthquake or high winds. Dynamic compression loading comes from movement of the wall.

By using rods with larger diameter than typically used for holding down a wall for tension forces as when the wall is lifted up due to earthquakes or high winds, the same rods advantageously function as posts to provide a direct path to the foundation for compression forces.

The present invention provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a horizontal first bridge member disposed between the first stud and the second stud, the first bridge member having a first vertical opening; a rod post having one end operably connected to the anchor rod and operably connected to the first bridge member to transfer downward forces from the first bridge member and the second bridge member to the rod post; the anchor rod is attached to an anchor; and the anchor is disposed in an upper portion of the foundation.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the

foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a horizontal first bridge member disposed between the first stud and the second stud, the first bridge member having a first vertical opening; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a horizontal second bridge member disposed between the third stud and the fourth stud, the second bridge member having a second vertical opening; a rod post having one end operably connected to the anchor rod and an opposite end received within the second vertical opening, the rod post extending through the first vertical opening, the first top plate and the second bottom plate; and the rod post is operably connected to the first bridge member and the second bridge member to transfer downward forces from the first bridge member and the second bridge member to the rod post.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; first floor joists supported by the first top plate; a first subfloor supported by the floor joists; a first horizontal compression plate disposed between the first top plate and the first subfloor, the first horizontal compression plate having a first opening; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; second floor joists supported by the second top plate; a second subfloor supported by the second floor joists; a second horizontal compression plate disposed between the second top plate and the second subfloor, the second horizontal compression plate having a second opening; a rod post having one end operably connected to the anchor rod and an opposite end received within the second opening, the rod post extending through the first top plate, the first opening, the first subfloor and the second bottom plate; and the rod post is operably connected to the first compression plate and the second compression plate to transfer downward forces from the first compression plate and the second compression plate to the rod post.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a first horizontal bridge member disposed between the first stud and the second stud, the first horizontal bridge member having a first vertical opening; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a second horizontal bridge member disposed between the third stud and the fourth stud, the second horizontal bridge member having a vertical second opening; a coupling having first threaded end and a second threaded end, the first threaded end being operably connected to the anchor rod, the second threaded end bearing on an underside of the first bridge member; a rod having one end operably attached to the first threaded end and an

opposite end received within the second opening, the rod extending through the first vertical opening, the first top plate and the second bottom plate; and the rod post is operably connected to the second bridge member to transfer downward forces from the second bridge member to the rod post.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a first coupling having a first internal threaded end and a second internal threaded end, the first internal threaded end being operably connected to the anchor rod; a first rod extending through between the first stud wall and the second stud wall, the first rod having a first end and a second end, the first end is threaded to the second internal threaded end; and a second coupling disposed in the second stud wall, the second coupling having a third internal threaded end and a fourth end, the third internal threaded end is connected to the second end of the rod, the fourth end is operably connected to the second stud wall.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a horizontal first bridge member disposed between the first stud and the second stud, the first bridge member having a vertical first opening; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a horizontal second bridge member disposed between the third stud and the fourth stud, the second bridge member having a vertical second opening; a first coupling having a first internal threaded end and a second internal threaded end, the first internal threaded end being operably connected to the anchor rod, the second internal threaded end bearing on a bottom of the first bridge member; a first rod extending through the first opening, the threaded rod having a third end and a fourth end, the third end is connected to the second internal threaded end; a second coupling having a fifth internal threaded end and a sixth internal threaded end, the fifth internal threaded end is connected to the fourth end, the fifth internal threaded end bearing on top of the first bridge member; a second rod having a seventh end and a eighth end, the seventh end is connected to the sixth threaded end one end and the eight end is received in the second opening, the second rod extending through the first top plate and the second bottom plate; and a nut threaded to the second rod and operably bearing on a bottom of the second bridge member for transferring downward forces from the first bridge member to the second rod.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a horizontal first bridge member disposed between the first stud and the second stud, the first bridge member having a vertical first opening; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a first coupling having a first internal threaded end and a second internal threaded end, the first internal threaded end being operably connected to the anchor rod, the second internal threaded end bearing on a bottom of the first bridge member; a headless bolt extending into the first opening, the threaded rod having a third end and a fourth end, the third end is connected to the second internal threaded end; a second coupling having a fifth internal threaded end and a sixth internal threaded end, the fifth internal threaded end is connected to the fourth end, the fifth internal threaded end is disposed inside the first vertical opening, the fifth internal threaded end bearing on top of the first coupling; and a second rod having a seventh end and a eighth end, the seventh end is connected to the sixth threaded end one end and the eight end is operably attached to the second stud wall.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a horizontal bridge member disposed between the first stud and the second stud; and a rod post having a first end and a second end, the first end is operably connected to the anchor rod, the second end is operably connected to the bridge member to transfer downward forces from the bridge member to the rod post.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a horizontal bridge member disposed between the third stud and the fourth stud, the bridge member having a threaded vertical opening; and a rod post having one end operably connected to the anchor rod and an opposite end threaded to the threaded vertical opening of the bridge member to transfer downward forces from the bridge member to the rod post.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; floor joists supported by the first top plate; a subfloor supported by the floor joists; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a compression plate bearing on an underside of the subfloor, the compression plate having a threaded opening; and a rod post having one end operably connected to the anchor rod and an opposite end threaded to the threaded

opening of the compression plate to transfer downward forces from the compression plate to the rod post.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs extending between the second bottom plate and the second top plate, the third and fourth studs having bottom ends; a compression plate having an opening and disposed on the second bottom plate, the bottom ends of the third and fourth studs bearing on the compression plate; and a rod post having one end operably connected to the anchor rod and an opposite end operably connected to the opening of the compression plate to transfer downward forces from the compression plate to the rod post.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate, a second top plate and third and fourth vertical studs extending between the second bottom plate and the second top plate, the third and fourth studs having bottom ends; a third stud wall disposed above the second stud wall; the third stud wall having a third bottom plate, a third top plate and fifth and sixth vertical studs operably joined to the third bottom plate and the third top plate; a compression plate having a first opening and disposed on the second bottom plate, the bottom ends of the third and fourth studs bearing on the compression plate; a bridge member disposed on the third bottom plate, the bridge member having a second opening; and a rod post extending through the first opening of the compression plate, the rod post having one end operably connected to the anchor rod and an opposite end operably connected to the second opening of the bridge member to transfer downward forces from the bridge member to the rod post.

The present invention also provides a reinforced building wall, comprising a stud wall disposed above a foundation; the stud wall having a bottom plate, a top plate and first and second vertical studs operably joined to the bottom plate and the top plate; a compression plate bearing on an underside of the top plate, the compression plate is disposed between the first stud and the second stud, the compression plate having an opening; and a rod post having one end operably anchored to the foundation and an opposite end operably attached to the compression plate to transfer downward forces from the compression plate to the rod post.

The present invention further provides a reinforced building wall, comprising a foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the bottom plate and the top plate; a horizontal first bridge member disposed between the first stud and the second stud; and a first rod post having a first end and a second end, the first end bears directly on the foundation, the second end is operably connected to the bridge member to transfer downward forces from the bridge member to the first rod post.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a horizontal bridge member disposed between the first stud and the second stud, a vertical opening extending from top to bottom of the bridge member; a cylindrical body disposed in the vertical opening with a first threaded end extending past the top and a second threaded end extending past the bottom of the bridge member, the cylindrical body including a central opening; a first bearing plate with a first threaded opening threaded to the first threaded end to bear on the top of the bridge member; a second bearing plate with a second threaded opening threaded to the second threaded end to bear on the bottom of the bridge member; and a first rod post having a first end and a second end, the first end is operably connected to the anchor rod, the second end is operably attached to the cylindrical body.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; first floor joists supported by the first top plate; a first subfloor supported by the first floor joists; a first horizontal bridge member disposed between the first top plate and the first subfloor, the first horizontal bridge member having a first opening, the first bridge member extending between the first top plate and the first subfloor; and a rod post is operably connected to the anchor rod and the first bridge member to transfer downward forces from the first bridge member to the rod post.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; first floor joists supported by the first top plate; a first subfloor supported by the first floor joists; a first horizontal bridge member disposed between the first top plate and the first subfloor, the first horizontal bridge member having a first opening, the first bridge member extending between the first top plate and the first subfloor; a first cylindrical body disposed in the first opening with a first end extending past a top and a second end extending past a bottom of the first horizontal bridge member, the first end including a first exterior thread and a first threaded bore, the second end including a second exterior thread and a second threaded bore; a first bearing plate with a first threaded opening threaded to the first exterior thread end to bear on the top of the first horizontal bridge member; a second bearing plate with a second threaded opening threaded to the second exterior thread to bear on the bottom of the first horizontal bridge member; and a rod post is operably connected to the anchor rod and the second bore to transfer downward forces from the first bridge member to the rod post.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; first floor joists supported by the first top plate; a first subfloor

supported by the first floor joists; a first cylindrical body disposed between the first top plate and the first subfloor; and a rod post is operably connected to the anchor rod and threaded to the first central opening.

The present invention further provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a cross-laminated timber (CLT) floor panel supported by the first top plate; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate supported by the CLT floor panel, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a first cylindrical body disposed between the first top plate and the second bottom plate, the first cylindrical body extending through the CLT floor panel, the first cylindrical body including a first central opening with a first threaded portion; the first cylindrical body including a first threaded end and a second threaded end; a first bearing plate with a first threaded opening threaded to the first threaded end to bear against the CLT floor panel; a second bearing plate with a second threaded opening threaded to the second threaded end to bear against the CLT floor panel; and a rod post operably connected to the anchor rod and threaded to the first central opening.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a cross-laminated timber (CLT) floor panel supported by the first top plate; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate supported by the CLT floor panel, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a body embedded in the CLT floor panel, the body including a threaded opening; and a rod post operably connected to the anchor rod and threaded to the threaded opening of the body.

The present invention also provides a reinforced building wall, comprising a foundation and an anchor rod anchored to the foundation; a first stud wall disposed above the foundation; the first stud wall having a first bottom plate, a first top plate and first and second vertical studs operably joined to the first bottom plate and the first top plate; a cross-laminated timber (CLT) floor panel supported by the first top plate; a second stud wall disposed above the first stud wall; the second stud wall having a second bottom plate supported by the CLT floor panel, a second top plate and third and fourth vertical studs operably joined to the second bottom plate and the second top plate; a first body bearing on the second bottom plate, the body including a first threaded opening; a rod post operably connected to the anchor rod and extending through the top plate, the CLT floor panel and the second bottom plate, the rod post is threaded to the threaded opening of the body; a second body including a second threaded opening threaded to the rod post to bear on an underside of the first top plate.

The present invention further provides a building wall, comprising a foundation made of a wood beam; studs extending upwardly from the wood beam; and a metal post having a bottom end operably bearing on the wood beam to transfer compression forces from the metal post to the wood beam.

The present invention also provide a building wall, comprising a foundation made of a wood beam having a first opening extending from a top surface to a bottom surface of the wood beam; studs extending upwardly from the wood beam; a first bearing plate disposed on a top surface of the wood beam, the first bearing plate including a second opening; a second bearing plate disposed on a bottom surface of the wood beam, the second bearing plate including a third opening; a rod post including a bottom end portion extending through the first opening, the second opening and the third opening; and the rod post is operably attached to the first bearing plate and the second bearing plate to transfer compression forces and tension forces from the rod post to the wood beam.

The present invention further provides a building wall, comprising a foundation made of a wood beam having a first opening extending from a top surface to a bottom surface of the wood beam; studs extending upwardly from the wood beam; a bearing plate disposed on a bottom surface of the wood beam, the bearing plate including a second opening; the rod post includes a first diameter and the bottom end portion of the rod post includes a second diameter smaller than the first diameter; the rod post includes a shoulder at a juncture where the bottom end portion with the second diameter meets the rod post with the first diameter; the bottom end portion extending through the first opening and the second opening, with the shoulder bearing on a top surface of the wood beam; and the second opening is threaded to the bottom end portion to bear on a bottom surface of the wood beam.

The present invention provides a building wall, comprising a foundation made of a steel beam including a first flange and a second flanged joined together by a web; a stud wall above the steel beam, the stud wall including a base plate disposed on the first flange; and a rod post having a bottom end portion extending through the bottom plate and bearing on the first flange.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1-62** show several embodiments of attaching a bridge member to the building wall to transfer compression loads or forces directly to the foundation via a rod post.

FIGS. **63-174** show various embodiments of connections of a rod post to the bridge member.

FIGS. **175-192** show connections of a rod post to a wood beam foundation.

FIGS. **193-210** show connections of a rod post to a metal beam foundation.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, a shear wall **2** supported incorporating the present invention is disclosed. The shear wall **2** forms a part of a building. The wall **2** is shown is a 3-story wall, comprising a lower wall **3**, a middle wall **5** and an upper wall **7**. It should be understood that the wall **2** may be more or less than 3 stories, where the middle wall **5** may be made of one or more walls above the lower wall **3** and below the upper wall **7**.

The wall **2** is supported on a concrete foundation **4**. It should be understood that the foundation **4** can also be a steel I-beam, wood beam, concrete slab, or a concrete wall that is directly or indirectly anchored to the ground. The wall **2** is made of vertical studs **6**, which may be wood or metal. Wall sheathing **8** is operably attached to the studs **6**, such as

with nails or screws. The studs **6** are operably attached to respective horizontal bottom plates **12** and horizontal top plates **14**. Floor joists **16** are supported on the respective top plates **14**. Subfloors **36** are supported by respective floor joists **16**. Subfloors **36** are typically made of plywood sheets laid out over the floor joists **16**.

An anchor **18** is embedded in concrete in the foundation **4** in the upper portion of the foundation **4**. Depending on the size of the foundation **4**, the anchor **18** may be able to handle both compression and tension forces with the appropriate location of the anchor **18** within the foundation **4**. For example, if the anchor **18** is located in the upper portion of the foundation **4**, the anchor **18** will be able to handle compression forces through the shear cone **19**. If the anchor **18** is located deeper into the foundation **4**, the anchor **18** will be able to handle both compression and tension forces through the shear cones **19** and **65** (see FIG. **27**).

The anchor **18** may be a standard nut, a metal plate, a cylindrical body, or any of the anchors disclosed in U.S. Pat. Nos. 8,943,777, 9,097,001, 9,222,251, 9,416,530, 9,447,574, 9,702,139, 9,874,009, hereby incorporated herein by reference. The location of the anchor near the top of the foundation **4** advantageously provides a larger shear cone **19** as compared to a location of the anchor **18** toward the bottom of the foundation **4**. The shear cone **19** is generated when the anchor **18** is subjected to compression loading from the wall **2**. Further discussion of shear cones may be found, for example, in U.S. Pat. No. 8,943,777, and application Ser. No. 15/429,345, filed Feb. 10, 2017, both of which are hereby incorporated herein by reference.

A rod post **20** is operably attached to an anchor rod **21** with a coupling **22**. The anchor rod **21** is operably attached to the anchor **18**. The rod post **20** extends through openings in the compression bridge members **26** and through openings in the top plates **14** of the lower wall **3** and the bottom plate **12** of the middle wall **5**. The rod post **20** may be threaded or unthreaded (except where needed as disclosed herein), as shown in the various drawings herein, of sufficient diameter, such as 2 inches or more, to prevent bowing or bending from compression loads. The rod post **20** is advantageously connected directly to the foundation **4** to provide a direct path for the loads to the foundation.

The diameter of the rod post **20** may change from floor to floor, depending on the number of walls being supported above each wall. For example, for the lower wall **3**, the diameter of the rod post below the bridge member may be larger than the diameter of the rod post above. Coupling a larger diameter rod post to a smaller diameter is disclosed herein.

The openings through the bridge members **26** may be threaded or unthreaded. One compression bridge member is disposed in the lower wall **3** and the other compression bridge member **26** in the middle wall **5**. The compression bridge members may be made of sawn lumber, engineered wood, metal, plastic, etc. The compression bridge members **26** are designed to transfer loading from the wall **2** to the rod post **20** and thence to the anchor **18** and the foundation **4**. Where the openings in the compression bridge members are unthreaded, nuts **24** disposed below the bridge member and threaded to the rod post **20** advantageously transfer the compression or downward forces from the compression bridge members **26** to the rod post **20**. Where the openings in the compression bridge members are unthreaded, nuts **24** disposed above the bridge member and threaded to the rod post **20** advantageously transfer the tension or upward forces from the compression bridge members **26** to the rod post **20**. Where the openings are threaded and the rod post is threaded to the openings, the threaded connection between the bridge member and the rod post advantageously transfer the compression or downward forces or the tension forces or upward from the bridge member to the rod post **20** without the use of the nuts **24**. The nuts **24** may be any metal body with a threaded hole, such as the threaded metal plate **228** shown, for example, in FIG. **147**, or a circular metal plate **298** shown, for example, in FIG. **154**.

Trimmer studs **28** extend from the underside of the respective bridge members **26** to the respective bottom plates **12** and from the top of the respective bridge members **26** to the respective top plates **14**. Compression and tension forces in the wall **2** are advantageously transferred to the compression bridge members **26** from the studs **6** and trimmer studs **28**. The trimmer studs **28** in the lower wall **3** are preferably doubled to advantageously provide a larger bearing surface **27** for the bridge member **26** to handle the expected larger loading from compression and tension forces at this location. The trimmer studs **28** in the middle wall **5** are preferably single to handle the reduced loading at that location. The bridge members **26** may also be attached directly to the studs **6**, as will be disclosed herein. The studs **6** and the trimmer studs **28** with ends bearing on the bridge members **26** advantageously transfer compression or tension forces from the wall **2** to the bridge members **26**. Connecting the bridge members **26** fixedly to the rod post **20** with the nuts **24** or the threaded connection advantageously transfer the compression or tension forces to the rod post **20** and thence to the foundation **4**.

Compression or downward forces **30** are due to wall weight, shifting or racking of the wall **2** at the opposite end caused by earthquake or high winds. Tension or upward forces **31** are due to lifting of the wall **2** from earthquake or high winds.

Referring to FIG. **2**, the wall **2** is shown with a cross-laminated timber (CLT) floor panel **32**. CLT is discussed in application Ser. No. 16/296,865, filed Mar. 8, 2019 and Provisional Application Ser. No. 62/800,966, filed Feb. 4, 2019, both of which are hereby incorporated herein by reference. The rod post **20** extends through an opening in the CLT floor panel **32**.

The CLT floor panel **32** is lightweight yet very strong, with superior acoustic, fire, seismic, and thermal performance, proving to be a highly advantageous alternative to conventional materials like concrete, masonry, or steel, especially in multi-family and commercial construction. Finished CLT panels are typically 2 to 10 feet wide, with lengths up to 60 feet and thickness up to 20 inches. Widths up to 18 feet and lengths up to 98 feet are possible. For additional information, see, for example, https://www.apawood.org/cross-laminated-timer, hereby incorporated herein by reference.

Wood posts **34** replace some of the trimmer studs **28** at the far end of the wall **2**. The use of the posts **34** advantageously provides greater load capacity for compression and tension loads. The wood posts **34** in the lower wall **3** extend from the underside of the bridge member **26** to the bottom plates **12** and from the top of the bridge member **26** to the top plates **14**. The wood post **34** in the middle wall **5** includes a slot **35** for receiving an end portion of the bridge member **26**. The wood posts **34** are typically 4×4, 4×6 or 6×6 inches, while the studs **6** or the trimmer studs **26** are typically 2×4 or 2×6 inches.

Referring to FIG. **3**, a subfloor **36** in place of the CLT floor panel **32** is disposed between the respective top plates **14** and the respective bottom plates **12**. Floor joists (not shown) are secured to other structural portions of the building.

Referring to FIG. **4**, a compression plate **38** is disposed between the bottom plate **12** and the bottom ends of the studs **6** and the trimmer studs **28**. Compression plates are disclosed in application Ser. No. 16/296,865, filed Mar. 8, 2019, which is a nonprovisional of Provisional Application Ser. No. 62/641,142, filed Mar. 9, 2018, both of which are hereby incorporated herein by reference. The compression plate **38** is advantageously harder than the bottom plate **12** to spread the forces from the studs **6** and the trimmer studs **28** over a larger area on the bottom plate **12** to minimize crushing of the bottom plate **12**. The compression plate **38** may be made of a harder species of wood than the bottom plate **12**. The compression plate **38** may also be made of engineered wood, metal, plastic.

Referring to FIG. **5**, the compression plate **38** and the bottom plate **12** may include openings in which inserts **40** may be placed to directly transfer the compression load from the studs to the foundation **4**. The inserts **40** may be made of material with compressive strength greater than the compressive strength of the studs **6** or the trimmer studs **28**, such as metal, plastic, engineered wood, hardwood, etc.

Referring to FIGS. **6** and **7**, the bridge member **26** in the lower wall **3** is supported in the rod post **20** by a nut **24**. A compression block **41**, made of the same material as the bridge member **26**, has a threaded opening **43** for threadedly receiving the anchor rod **21**. Compression forces from the rod post **20** are transferred to the compression block **41**, which spreads the forces over the bottom plate **12**. The compression forces are also transferred to the anchor **18** and the foundation **4**. No trimmer studs are disposed below the bridge member **26**, since the nut **24** provides the load transfer from the bridge member **26** to the rod post **20**. The bridge member **26** may be nailed or screwed to the studs **6**.

The anchor **18** is preferably embedded in the upper portion of the foundation **4** to generate a larger shear cone **19** for compression forces. The anchor **18** may be located below the top surface of the foundation **4**. The anchor **18** may also be flush with the top surface of the foundation **4** so that the bottom plate **12** can lay flat on the foundation **4**. The anchor **18** is advantageously threaded to the anchor rod **21** transfer the compression forces from the rod post **20** to the foundation **4**. The nut **24** underneath the anchor **18** advantageously provides a stop to properly position the anchor **18** on the anchor rod **21** so that the requirement amount of thread is engaged with the anchor **18**. A checker nut as disclosed in U.S. Pat. No. 8,806,835, hereby incorporated herein by reference may also be used instead of a standard nut.

Referring to FIG. **8**, the bridge member **26** in the lower wall **3** may be made of wood of the same species as the studs **6**, in which case compression plates **38** are disposed below and above the bridge member **26** to advantageously increase the compressive capacity of the bridge member **26**. The trimmer studs **28** extend from the top of the upper compression plate **38** to the underside of the top plate **14** to advantageously transfer compression forces from the wall to the upper compression plate **38** and the bridge member **26**. The compression plates **38** are preferably as long and as deep as the bridge members **26**

Referring to FIG. **9**, a bridge member **44** made of engineered wood replaces the bridge member **26** in the lower wall **3** as shown in FIG. **8**. A compression plate **38** is disposed on the bottom surface of the bridge member **44** to advantageously spread the compression forces on the nut **24**. The bridge member **44** may be attached to the studs **6** with screws or nails. The rod post **20** extends through a hole in the bridge member **44**.

Referring to FIG. **10**, the bridge members **26** are disposed directly underneath the respective top plates **14** of the lower wall **3**, the middle wall **5** and the upper wall **7**. Compression loading from the wall is transferred from the respective top plates **14** to the respective bridge members **26** to the rod post **20** and thence to the foundation **4** via the anchor **18**. The bridge members **26** and the rod post **20** advantageously provide a direct path for the compression forces to the foundation **4**.

Referring to FIG. **11**, the CLT floor panels **32** are disposed between the respective bottom plates **12** and the respective top plates **14**. The rod post **20** extends through respective openings in the CLT floor panels **32**.

Referring to FIG. **12**, a subfloor **36** in place of the CLT floor panel **32** is disposed between the respective top plates **14** and the respective bottom plates **12**. Floor joists (not shown) are secured to other structural portions of the building.

Referring to FIGS. **13** and **14**, compression plates **46** are disposed directly below the subfloor **36** in the lower wall **3** and the middle wall **5**. Blocking members **48** are disposed between the respective compression plates **46** and the top plates **14**. The compression plates **46** are fully supported by the respective blocking members **48**. Compression forces are transferred to the nuts **24** and thence to the rod post **20**. The blocking members **48** advantageously transfer some of the compression forces on the compression plate **46** to the studs **6**.

Referring to FIGS. **15** and **16**, a compression bridge member **50**, I-shaped as an I-beam and made of solid metal, is disposed on the bottom plate **12** of the upper wall **7**. The bridge member **50** has a threaded hole **51** threadedly attached to the rod post **20**. The threaded attachment advantageously provides for the transfer of compression forces directly to the rod post **20**. The bottom ends of the studs **6** bear on the top side of the bridge member **50**. Since the bridge member **50** has greater compressive strength than the studs **6** and the top plate **12**, compressive forces are spread over a larger area than the actual footprint of the bottom ends of the studs **6**, thereby to minimize crushing the bottom plate **12**. The compression bridge member **50** is shown in detail in FIGS. **54** and **55**.

The compression plate **38** in the middle wall **5** provides the same function as the bridge member **50**. A nut (not shown but see FIG. **18** for the nut engaging the underside of the bridge member **52**) threaded to the rod post **20** and engaging the underside of the compression plate **38** advantageously transfers compression loading on the compression plate **38** directly to the rod post **20**. The rod post **20** extends through an unthreaded hole in the compression plate **38** to advantageously isolate the compression loading on the compression plate **38** from wall. The anchor **18** would be located at an appropriate depth within the foundation **4** to handle both compression and tension forces or another anchor **56** (see FIG. **27**) may be added and located at an appropriate depth to handle tension forces.

Referring to FIGS. **17** and **18**, the compression bridge member **50** is modified as bridge member **52** with an unthreaded hole **53**. The nut **24** connects the bridge member **52** to the rod post **20**. An opening **55** in the bottom plate **12** and the subfloor **36** allows the nut **24** to reach the bottom of the bridge member **52**.

Referring to FIG. **19**, a compression plate **54** made of solid metal is disposed on the bottom plate **12** with a threaded opening **57** for threadedly receiving the rod post **20**. The compression plate **54** advantageously allows the transfer of compression (downward direction) or tension

(upward direction) forces to the rod post **20** and thence to the foundation **4**. The compression plate **54** advantageously spreads the compression forces at the bottom ends of the studs **6** over a larger area on the bottom plate **12**.

The coupling **22** includes an inspection opening **59** preferably disposed halfway between the opposite ends of the coupling. The inspection opening **59** advantageously provides a visual check on the engagement of the end surfaces **61** of the rod posts **20** at the halfway point inside the coupling. This insures that the rod posts **20** are sufficiently attached to the coupling **22**. The coupling **22** may have hexagonal outside surfaces to advantageously facilitate the use of a wrench or similar tool in the installation of the coupling.

Referring to FIG. **20**, one end **49** of the compression plate **54** is longer than a stud bay defined by the distance or space between the two outermost studs **6**. The compression plate **54** extends outside the stud bay past the second stud **6** to advantageously allow the compression forces from the stud **6** bearing at that end to be spread over a larger area on the bottom plate **12**. This is further discussed in co-pending application Ser. No. 16/296,865, hereby incorporated herein by reference. A stud bay is a distance or space between two outermost studs, typically 16 inches apart.

Referring to FIG. **21**, the compression plate **38** has an unthreaded opening **63**. Nuts **24** above and below the compression plate **38** attach the compression plate to the rod post **20**. The opening **55** in the bottom plate **12** and the subfloor **36** advantageously provides room for the lower nut **24** to directly engage the bottom of the compression plate **38**.

Referring to FIG. **22**, one end **47** of the compression plate **38** extends outside the stud bay past the stud **6** to advantageously allow the compression forces from the stud **6** bearing at that end to be spread over a larger area on the bottom plate **12**, as is the case with the end **49** in FIG. **20**.

Referring to FIGS. **23**, **24**A and **24**B, bridge members **26** are disposed against the respective top plates **14** in the lower wall **3** and the middle wall **5**. The bridge members **26** have unthreaded openings through which the rod post **20** extends. Nuts **24** hold the respective bridge members **26** to the rod post **20** and provide transfer of the compression forces from the bridge members **26** to the rod post **20**. Compression plates **38** are disposed on the respective bottom plates **12** in the middle wall **5** and the upper wall **7**. The bottom ends of the trimmer studs **28** bear on the compression plates **38** disposed on the bottom plates **12**.

A compression plate **38** is also attached to the top plate **14** in the upper wall **7**. A nut **24** holds the compression plate **38** against the top plate **14** and to the rod post **20** so that compression forces from the wall is transferred to the compression plate **38** and the rod post **20**. The compression plate **38** is supported by the top ends of the trimmer studs **28**. The compression plate **38** has an unthreaded opening **63** through which the rod post **20** extends. Compression forces from the trimmer studs **28** pass through the compression plate **38** but are not transferred to the rod post **20** due to lack of connection between the compression plate **38** and the rod post **20** provided by the unthreaded opening **63**, as shown in FIG. **24**A.

The bridge member **26** in the middle wall **5** is supported by the top ends of the trimmer studs **28**. The compression plate **38** connects with the rod post **20** with the nut **24** in the opening **55**, as shown in FIG. **24**B. The nut **24** serves to transfer the compression loading from the compression plate **38** to the rod post **20**.

Referring to FIGS. **25** and **26**A, the compression plate **38** on the bottom plates **12** in the upper wall **7** is attached to the rod post **20** via the nuts **24**, as shown in FIG. **26**A. The opening **63** is unthreaded so that the nuts **24** above and below the compression plate **38** are used to attach the compression plate to the rod post **20**. The compression plate **38** as attached to the rod post **20** is able to transfer compression (downward direction) or tension (upward direction) forces to the rod post **20**.

Referring to FIGS. **25** and **26**B, the compression plate **54** on the bottom plate **12** in the middle wall **5** is threaded to the rod post **20** through the threaded opening **57**. The compression plate **54** as attached to the rod post **20** is able to transfer compression (downward direction) or tension (upward direction) forces to the rod post **20**.

Referring to FIG. **27**, the compression plates **38** on the respective bottom plates **12** of the middle wall **5** and the upper wall **7** are used to transfer tension forces to the rod post **20**. The bridge members **26** and the compression plate **38** engaging the top plate **14** of the upper wall **7** are used to transfer compression forces to the rod post **20**. The wall is advantageously configured to resist upward (tension) and downward (compression) forces.

A bearing plate **60**, preferably made of metal, engineered wood, or plastic with compressive strength greater than the compressive strength of the underlying lumber, is attached to the rod post **20** with the nut **24**. Tension forces from the bearing plate **60** are effectively transferred to rod post **20**.

An anchor **56** is embedded in the bottom portion of the foundation **4** below the anchor **18**. The anchor rod **21** extends below the anchor **18** and the anchor **56** is operably attached to an end portion of the anchor rod **21**. The location of the anchor **56** in the bottom portion of the foundation **4** advantageously provides a larger shear cone **65** as compared to a location of the anchor **56** in the upper portion of the foundation **4**. The placement of the anchor **56** advantageously provides a larger shear cone **65** to resist tension forces on the rod post **20**. The anchor **56** may be a metal plate, cylindrical body, a nut, or any of the anchors disclosed in U.S. Pat. Nos. 8,943,777, 9,097,001, 9,222,251, 9,416,530, 9,447,574, 9,702,139, 9,874,009, hereby incorporated herein by reference.

Referring to FIG. **28**, the compression plates **38** disposed on the respective bottom plates of the middle wall **5** and the upper wall **7** have been replaced with the bearing plates **60**. A bridge member **58** preferably made of sawn lumber is disposed in the upper wall **7**. Trimmer studs **28** extend from the bottom plate **12** to the underside of the bridge member **58** and from the top of the bridge member **58** to the top plate **14**. Compression forces on the compression plate **38** are transferred to the rod post **20** via the nut **24**. Tension forces on the bearing plates **60** are transferred to the rod post **20** via the associated respective nuts **24**. The wall is advantageously configured to resist upward (tension) and downward (compression) forces.

Referring to FIG. **29**, bridge members **58** are disposed in the respective lower wall **3** and the middle wall **5**. The bridge member **58** is preferably made of sawn lumber. Bearing plates **39** are disposed on the bottom of the respective bridge members **58**. The bearing plates **39** are preferably shorter in length than the bridge members **58**. Nuts **24** advantageously transfer compression forces on the bearing plates **39** to the rod post **20**. Trimmer studs **28** extend from the top of the bridge members **58** to the respective top plates **14** of the lower wall **3** and the middle wall **5**.

Referring to FIGS. **30** and **35**, a large diameter solid metal coupling **62** attached to the anchor rod **21** and the rod post

20, which extends through an opening in the bridge member 26. The coupling 62 advantageously provides more loading capacity than the rod post 20. The coupling 62 has a top edge surface 67 that bears on the underside of the bridge member 26. Threaded bores 69 are threadedly attached to the respective ends of the rod post 20 and the anchor rod 21. The bridge member 26 is preferably metal to advantageously provide appropriate loading capacity around the edge surface 67. The bottom end of the coupling 62 is spaced from the bottom plate 12 so that compression forces are advantageously directly transferred to the anchor 18 and the foundation 4.

Referring to FIG. 31, a bearing plate 64 is disposed between the bottom end of the coupling 62 and the bottom plate 12. The bearing plate 64 is preferably made of metal, engineered wood, plastic with compressive strength greater than the compressive strength of the bottom plate 12 to distribute the compression forces from the bottom edge surface of the coupling 62 over a larger area on the bottom plate than the actual footprint of the coupling 62.

Referring to FIG. 32, another large diameter solid metal coupling 62 is disposed in the lower wall 3 between the bridge member 26 and the top plate 14. A short threaded rod post 20 (see FIG. 35) extends across the bridge member 26 to connect the lower and upper couplings 62 together.

Referring to FIG. 33, a compression plate 38 is placed between the top end of the upper coupling 62 and the top plate 14 in the lower wall 3. Compression forces from the top plate 14 are transferred to the compression plate 38 and thence to the couplings 62. The lower end of the rod post 20 extends across the top plate 14 of the lower wall 3 to connect with the upper end of the upper coupling 62.

Referring to FIG. 34, the bridge member 26 in the lower wall 3 is disposed against the top plate 14 and the coupling 62 extends between the bottom plate 12 and the underside of the bridge member 26. The lower end of the rod post 20 extends across the bridge member and connects to the upper end of the coupling 62 (see FIG. 35).

Referring to FIG. 35, the coupling 62 is a solid rod with threaded bores 69 at each end for threaded connecting to the rod post 20 or the tie rod 21. Edge surface 67 around the upper threaded bore 69 provides a bearing surface for engaging against the bridge member 26 or the compression plate 38. The rod post 20 extends through an opening in the bridge member 26. The rod post 20 is not threaded to the bridge member 26 so that only compression forces are transferred to the coupling 62.

Referring to FIG. 36, the large diameter coupling 62 may be hollow or tubular as embodied in the coupling 66 with a through opening 71. The ends of the opening 71 are threaded for attachment to the end of the rod post 20 or the anchor rod 21. The rod post 20 is not threaded to the bridge member 26 so that only compression forces are transferred to the coupling 66.

Referring to FIG. 37, a bridge member 42 with a partly threaded hole 45 is disposed in the lower wall 3. The rod post 20 is threadedly attached to the bridge member 42. Trimmer studs extend from the top of the bridge member 42 to the underside of the top plate 14.

Referring to FIG. 38, the bridge member 42 engages the underside of the top plate 14.

Referring to FIG. 39, a compression plate 68 with a threaded opening 73 is disposed against the underside of the subfloor 36 of the middle wall 5. The compression plate 68 is threadedly attached to the rod post 20 and supported by the blocking members 48.

Referring to FIG. 40, the compression plate 68 is disposed on the bottom plate 12 of the middle wall 5. The bottom ends of the studs 6 and the trimmer studs 28 are supported on the compression plate 68.

Referring to FIG. 41, one end of the compression plate 68 extends beyond the stud bay to allow the compression forces to be spread over a larger area of the bottom plate 12. This is further discussed in co-pending application Ser. No. 16/296,865, hereby incorporated herein by reference.

Referring to FIG. 42, the bridge member 42 is disposed in the middle wall 5. Trimmer studs extend from the top of the bridge member 42 to the underside of the top plate 14 (not shown).

Referring to FIG. 43, the bridge member 42 engages the bottom of the top plate 14 of the middle wall 5.

Referring to FIG. 44, the couplings 62 are installed in the respective lower wall 3 and the middle wall 5. The rod post 20 extends through the bottom plate 12 and the subfloor 36 of the middle wall 5 and through the top plate 14 of the lower wall 3 to connect the couplings 62 together. The upper end of the coupling 62 in the upper wall 5 is operably connected to the wall, such as with the bridge member 42 as shown in FIG. 43. The coupling 62 in the upper wall 5 replaces the rod post 20 shown in the upper wall

Referring to FIG. 45, the coupling 62 may be modified as a coupling 70 with hexagonal outside surface in cross-section.

Referring to FIGS. 46, 47 and 47, a coupling 72 is disposed in the middle wall 5, in addition to the coupling 62 in the lower wall 3. A rod post 20 extending between the lower wall 3 and middle wall 5 connects the couplings 62 and 72 together. The coupling 72 has a rectangular outside surface in cross-section. The coupling 72 has an upper top surface 75 which engages the underside of the top plate 14. The threaded bore 69 includes a radial sight hole 77 to provide a visual check on the penetration of the rod post 20 into the threaded bore 69 to insure maximum thread engagement.

Referring to FIG. 49, the studs 6 and the trimmer studs 28 are shown disposed within a half-bay of a normal stud bay. For example, for a normal stud bay of 16 in. width, a half-bay is about 8 in. The half-bay advantageously provides additional strength to the rod post 20.

Referring to FIG. 50, the trimmer studs 28 are not attached to the adjacent studs 6. In the middle wall 5, the stud that would have been located in a normal stud bay is not used.

Referring to FIG. 51, various locations of compression bridge members within a wall are shown. Compression bridge members 76 may be placed on the respective bottom plates 12 of the respective bottom plates 12 of the lower wall 3, the middle wall 5 and the upper wall 7. Similarly, the compression bridge members 80 may be placed against the underside of the top plates of the respective lower wall 3, the middle wall 5 and the upper wall 7. The compression bridge members 78 may be placed between the bottom plate 12 and the top plate 14 in the lower wall 3, the middle wall 5 and upper wall 7. The compression bridge members 52 may be placed within the joist space between the top plate 14 of the wall below and the bottom plate 12 of the wall above.

Referring to FIG. 52, a cross-sectional view of a solid metal bridge member 85 is shown. A partly threaded opening 86 provides connection to the rod post 20.

Referring to FIG. 53, a cross-sectional view of a solid metal compression plate 54 is shown. The compression plate 54 is shown installed in the wall in FIG. 19.

Referring to FIGS. **54** and **55**, the bridge member **50** is shown in cross-section in FIG. **54**. The opening **51** is partly threaded for attachment to the rod post **20**. The bridge member **50** is shown installed in FIG. **16**. The bridge member **50** is I-shaped, with upper and lower flanges **79** joined by a web **81**. The web **81** is thick enough to accommodate the opening **51**. The threaded portion of the opening **51** is advantageously disposed in the lower flange **79**.

Referring to FIG. **56**, a compression bridge member **88** made of extruded metal is shown. The bridge member **88** includes a matrix of rectangular openings **89** extending from top to bottom. An opening **87** extends from top to bottom for receiving the rod post **20**.

Referring to FIG. **57**, a compression bridge member **90** made of extruded metal is disclosed. The bridge member **90** is hollow, defined by a rectangular opening **91** extending from one end to the other end and a plurality of rectangular openings **93** on each side of the rectangular opening **91**. An opening **95** at the top is aligned with an opening (not shown) at the bottom for receiving the rod post **20**.

Referring to FIG. **58**, a solid metal compression bridge member **92** is disclosed with a threaded opening **96** extending from top to bottom for receiving the rod post **20**.

Referring to FIG. **59**, a hollow metal compression bridge member **94** with a matrix of holes **98** with a common vertical direction extending from top to bottom is disclosed relative to the vertical direction of the rod post **20**. The threaded opening **96** extends from top to bottom for receiving the rod post **20**.

Referring to FIG. **60**, a hollow metal compression bridge member **100** with a matrix of holes **101** with a common horizontal direction, extending from front to back is shown relative to the vertical direction of the rod post **20**. The threaded opening **96** extends from top to bottom for receiving the rod post **20**.

Referring to FIG. **61**, a hollow metal compression bridge member **100** with a matrix of threaded holes **103** with a common horizontal direction, extending from left to right is shown relative to the vertical direction of the rod post **20**. The threaded opening **96** extends from top to bottom for receiving the rod post **20**.

Referring to FIG. **62**, a hollow metal compression bridge member **100** with a matrix of holes **105** with a common horizontal direction, extending from left to right is shown relative to the vertical direction of the rod post **20**. The threaded opening **96** extends from top to bottom for receiving the rod post **20**.

Referring to FIG. **63**, the rod post **20** is shown extending through an unthreaded opening **106** and supporting the compression bridge member **26** with the nut **24**. With this arrangement, the bridge member **26** is able to transfer compression forces to the rod post **20**.

Referring to FIG. **64**, the rod post **20** is shown extending through an unthreaded opening **106** and capturing the compression bridge member **26** with the nuts **24**. The bridge member **26** is able to transfer compression and tension forces to the rod post **20**.

Referring to FIG. **65**, the rod post **20** is shown threaded to a threaded opening **108** in the compression bridge member **26**. The bridge member **26** is able to transfer compression and tension forces to the rod post **20**.

Referring to FIG. **66**, the rod post **20** is shown threaded to a threaded bore **110** in the compression bridge member **26**. The bridge member **26** is able to transfer compression and tension forces to the rod post **20**.

Referring to FIG. **67**, the two rod posts **20** with their respective ends **112** and **114** are shown threaded to the threaded opening **108** in the compression bridge member **26**. The bridge member **26** serves to couple the two rod posts **20** together. The bridge member **26** is able to transfer compression and tension forces to the rod posts **20**.

Referring to FIG. **68**, a tie rod **122** is coupled to the rod post **20** within an opening **115** the bridge member **26**. The opening **115** is multi-diameter, with a threaded opening **116** being of larger diameter than a threaded opening **120**. The tie rod **122** is shown threaded to threaded opening **120** and the rod post **20** to a threaded opening **116** in the compression bridge member **26**. The threaded opening **120** has a smaller diameter than the threaded opening **116**. Between the threaded opening **116** and the opening **120** is an unthreaded portion **118** of the opening **115**. The bridge member **26** is able to transfer compression and tension forces to the rod post **20**.

Referring to FIG. **69**, the bridge member **90** is shown installed in the lower wall **3**, engaging the underside of the top plate **14**. The nut **24** transfers compression forces from the bridge member **90** to the rod post **20**.

Referring to FIG. **70**, the bridge member **88** is shown installed in the lower wall **3**, engaging the underside of the top plate **14**. The nut **24** transfers compression forces from the bridge member **90** to the rod post **20**.

Referring to FIGS. **71** and **72**, the bridge member **88** is shown attached in the middle of the wall **3**. Screws **124** attach the bridge member **88** to the studs **6**. The nut **24** transfers compression forces from the bridge member **88** to the rod post **20**. The studs **6** are preferably doubled up to handle the expected load.

Referring to FIGS. **73** and **74**, the bridge member **88** is shown attached in the middle of the wall **3**. Screws **124** attach the bridge member **88** to the studs **6**. The nut **24** transfers compression forces from the bridge member **88** to the rod post **20**. The studs **6** are preferably not doubled due to a lesser amount of load expected than the arrangement shown in FIGS. **71** and **72**.

Referring to FIGS. **75** and **76**, the bridge member **44** is shown attached in the middle of the wall **3**. Screws **124** attach the bridge member **88** to the studs **6**. The nut **24** transfers compression forces from the bridge member **88** to the rod post **20**. The bearing plate **60**, preferably metal with higher compressive strength than the bridge member **44**, advantageously spreads the compressive forces over a larger area than the actual footprint of the nut **24**. The rod post **20** extends inside the bridge member **44** through an opening **123**. The bridge member **44** is made of engineered wood with the wood grain **125** running left to right, perpendicular to the rod post **20** and the direction of the compression forces.

Referring to FIGS. **77** and **78**, the bridge member **44** has wood grain **127** running vertically, parallel to the rod post **20** and the direction of the compression forces. The bridge member **44** with the wood grain running parallel to the direction of the compression forces has higher compressive strength than one with the wood grain running perpendicular to the direction of the compression forces.

Referring to FIG. **79**, bridge members **88** are installed in the respective lower wall **3** and middle wall **5**. The arrangement is designed for compression forces only since the bridge members **88** are not attached to the rod post **20** to handle tension forces (upward direction).

Referring to FIG. **80**, the bridge members **88** are installed for compression and tension forces. The nuts **24** above the respective bridge members **88** transfer the tension forces

from the bridge members **88** to the rod post **20**. The nuts **24** below the bridge members **88** transfer the compression forces from the bridge members **88** to the rod post **20**.

Referring to FIGS. **81** and **82**, a metal compression bridge member **128** is disposed inside the wall **3** between the base plate **12** and the top plate **14**. Trimmer studs **28** extend from the top of the bridge member **128** to the underside of the top plate **14**. A large diameter coupling **130** extends from the anchor rod **21** to the underside of the bridge member **128**. A smaller diameter coupling **132** extends from the top of the bridge member **128** to a threaded rod **129**. The coupling **132** has a smaller diameter than the coupling **130**. The coupling **132** extends through an opening **131** to bear on a top end surface **133** of the coupling **130**. In this manner, compression forces from the upper rod post **132** are advantageously transferred directly to the lower rod post **130**. A headless bolt or setscrew **134** joins the coupling **132** to the coupling **130**. There is no connection between the bridge member **128** and the coupling **132** so that compression forces from the coupling **132** are transferred directly to the coupling **130**. Compression forces from the coupling **132** do no transfer to the bridge member **128**. Inspection holes **138** communicate with the threaded bore holes inside the respective ends of the couplings **130** and **132** to advantageously provide a visual check of the engagement of the set screw **134**, the anchor rod **21** and the threaded rod **129** in the respective threaded bore holes.

The attachment of the compression plate **38** to the underside of the top plate **14** in the upper wall **7** as shown in FIG. **23** may be modified as shown in FIGS. **83-94** to allow for tensions forces to be transmitted to the rod post **20**.

Referring to FIG. **83**, the compression plate **38** is supported by the top ends of the trimmer studs **28** and engages the bottom of the top plate **14**. The rod post **20** extends through the unthreaded opening **63** and the opening **142** and is threaded to a bearing plate **140** disposed on the top of the top plate **14**. The nut **24** transfers compression forces from the compression plate **38** to the rod post **20**. The bearing plate **140** transfers tension forces from the top plate **14** to the rod post **20**.

Referring to FIG. **84**, the compression plate **54** is supported by the top ends of the trimmer studs **28** and engages the bottom of the top plate **14**. The compression plate **54** is threaded to the rod post **20** via the threaded hole **57** and extends through the opening **142** past the top of the top plate **14**. The compression plate transfers compression and tension forces to the rod post **20**.

Referring to FIG. **85**, the compression plate **54** is threaded to the rod post **20** via the threaded hole **57** and extends partway into a blind opening **144** in the top plate **14**. The compression plate transfers compression and tension forces to the rod post **20**.

Referring to FIG. **86**, the rod post **20** is threaded to the threaded opening **57** in the compression plate **54**. The rod post **20** extends through the opening **142** and is threaded to the bearing plate **140** disposed on the top of the top plate **14**. The threaded connection of the rod post **20** with the compression plate **54** transfers compression forces from the compression plate **54** to the rod post **20**. The bearing plate **140** transfers tension forces from the top plate **14** to the rod post **20**.

Referring to FIGS. **87** and **88**, the rod post **20** is threaded to the opening **57**. Nails **126** are used to attach the compression plate **54** to the underside of the top plate **14**. The nails **126** advantageously eliminate the use of the trimmer studs **28** for stabilizing the compression plate **54** when subjected to compression or tension loading.

Referring to FIGS. **89** and **90**, screws **124** are used to attach the compression plate **54** to the underside of the top plate **14**.

Referring to FIG. **91**, one end **135** of the compression plate **54** extends beyond the stud **6** in the stud bay to allow the compression forces exerted by the top end of the stud **6** to be spread over a larger area of the top plate **14**. The principle is the same as with the ends **49** and **47**, shown in FIGS. **20** and **22**.

Referring to FIG. **92**, the compression plate **54** spans only a part **74** of a typical stud bay.

Referring to FIGS. **93** and **94**, the rod post **20** may be attached to the compression plate **54** with a coupling nut **146** having a threaded opening **137** for attaching to the rod post **20** and a threaded projection **139** for threading into the threaded opening **57**. A shoulder **141** is formed around base of the projection **139** for engaging against the underside of the compression plate **54**. A radial sight hole **148** communicates with the opening **137** to provide a visual check on the required thread engagement of the coupling nut **146** with the rod post **20**. The projection **139** preferably extends through the thickness of the compression plate. The coupling nut **146** transfers both compression and tension forces from the compression plate **54** to the rod post **20**. The coupling nut **146** preferably has exterior hexagonal flat surfaces for engaging a wrench or similar tool.

Referring to FIGS. **95** and **96**, a compression plate **152** is attached to the rod post **20** with a sleeve **150** having a threaded opening **143** threadedly attached to the rod post **20**. A blind hole **154** receives a portion of the sleeve **150**. The sleeve **150** is advanced into the blind hole **154** until it engages the bottom surface **145** of the blind hole **154**. The radial sight hole **148** communicates with the opening **143** to provide a visual check on the required thread engagement of the sleeve **150** with the rod post **20**. The sleeve **150** transfers compressive forces from the compression plate **152** to the rod post **20**.

Referring to FIGS. **97** and **98**, the sleeve **150** may be long enough and the end **147** of the rod post **20** may be short of or spaced from the underside of the compression plate **152** to facilitate in connecting the rod post **20** to the compression plate **152**. As can be understood from the drawings, the sleeve **150** is initially positioned so that the top end of the sleeve **150** is some distance from the bottom of the compression plate **152**. The sleeve **150** is then advanced into the blind hole **154** until it engages the bottom surface **145**.

Referring to FIGS. **99** and **100**, the sleeve **150** engages the bottom surface of a compression plate **156**, which does not have the blind hole **154** found in the compression plate **152**. The sleeve **150** is turned around the rod post **20** until the top end of the sleeve **150** presses on the underside of the compression plate **156**. The compression plate **156** transfers compression forces to the rod post **20** through contact with the top end of the sleeve **150**.

Referring to FIGS. **101** and **102**, an unthreaded rod post **160** is attached to an unthreaded anchor rod **170** via an unthreaded coupling **164**. The upper end of the rod post **160** is disposed inside an unthreaded blind hole **162** in the compression bridge member **158**. The lower end of the rod post **160** is disposed inside the coupling **164**. The coupling **164** includes a radial internal wall **166**. The bottom end of the rod post **160** is inside the coupling **164** and engages the internal wall **166**. The upper end of the anchor rod **170** is disposed inside the coupling **164** and engages the other side of the internal wall **166**. Compression forces transferred

from the compression bridge member **158** to the rod post **160** are transferred directly to the anchor rod **170** via the internal wall **166**.

Referring to FIGS. **103** and **104**, an unthreaded coupling **168** connects the rod post **160** with the anchor rod **170**. The coupling **168** is fixedly attached to either the bottom end of the rod post **160** or the upper end of the anchor rod **170** to hold the coupling **168** in place. The bottom surface **172** of the rod **160** engages the top surface **174** of anchor rod **170** so that compression forces from the rod post **160** are transferred directly to the anchor rod **170** without passing through the coupling **168**. The coupling **168** merely holds and aligns the rod post **160** with the anchor rod **170**.

Referring to FIGS. **105** and **106**, a rod post **178** supports a compression bridge member **176**. The top surface **182** of the upper end of the rod post **178** engages the bottom exterior surface of the bridge member **176**. The rod post **178** does not penetrate the bridge member **176**. The bottom end of the rod post **178** includes an unthreaded blind hole **180** that received an upper end of the anchor rod **170**. Compression forces from the bridge member **176** are transferred to the rod post **178** through contact with the top surface **182**. Contact between the top surface of the upper end of the anchor rod **170** and the bottom of the blind hole **180** transfers the compression forces from the rod post **178** to the anchor rod **170** and thence to the anchor **18** and the foundation **4**.

Referring to FIGS. **107** and **108**, a single threaded rod post **186** is threaded to the compression plate **54**. The threaded rod post **186** is larger in diameter than a normal tie rod used to hold a wall against tension forces and thereby provides the function of a post. The bottom end of the rod post **186** extends through an opening **184** in the bottom plate **12** and bears directly on the top surface of the foundation **4** via the bottom surface **188** of the rod post **186**. Compression forces from the compression plate **54** are transferred to the rod **186** and thence to the foundation via the bottom surface **188** bearing on the top surface of the foundation **4**.

Referring to FIGS. **109** and **110**, the threaded rod post **186** is threaded to the compression bridge member **85**. The bottom end of the rod post **186** extends through an opening **184** in the bottom plate **12** and bears directly on the top surface of the foundation **4** via the bottom surface **188** of the threaded rod post **186**. Compression forces from the bridge member **85** are transferred to the rod post **186** and thence to the foundation via the bottom surface **188** bearing on the top surface of the foundation **4**. The threaded rod post **186** may be in two pieces, joined together by the coupling **22**.

Referring to FIGS. **111** and **112**, the rod post **186** is a single piece extending from the foundation to the bridge member **85**.

Referring to FIG. **113**, the compression bridge member **85** is threaded to the threaded rod post **186** for transferring compression and tension forces from the bridge member **85** to the rod post **20**. The compression bridge member **26** is not threaded to the rod post **186**. The rod post **186** merely extends through an unthreaded opening in the bridge member **26**. The nut **24** transfers compression forces from the bridge member **26** to the rod post **186**. The bottom surface **188** of the rod post **186** bears on the foundation **14** to transfer compression forces to the foundation.

Referring to FIGS. **114** and **115**, a compression bridge member **190** is used to join two sections of the rod post **186**. The bridge member **190** includes an upper threaded blind hole **191** and a lower threaded blind hole **192** to which the upper and lower sections of the rod post **186** are threaded, respectively.

Referring to FIG. **116**, a nonthreaded rod post **198** is used to transfer compression forces from a compression bridge member **194** to the foundation **4**. An upper end of the rod post **198** is disposed inside an unthreaded blind hole **196** in the bottom of the bridge member **196**. A bottom surface of the rod post **200** bears directly on the foundation **4**.

Referring to FIGS. **117** and **118**, a cylindrical metal post **204** supports a compression bridge member **202** and bears directly on the foundation **4**. A bottom exterior surface of the bridge member **202** bears on a top surface **201** of the post **204**. Compression forces from the bridge member **202** are transferred to the post **204** via the top surface **201** and to the foundation via the bottom surface **206** of the post **204**.

Referring to FIG. **119**, the post **204** may be a hollow or tubular metal post **208**. The bottom surface of the compression bridge member **202** bears on the top edge surface **203** of the post **208**. The bottom edge surface of the post **210** bears directly on the foundation **4** in transferring compression forces from the bridge member **202** to the post **208** and thence to the foundation **4**.

Referring to FIGS. **120** and **121**, the post **204** may be a metal post **212** with a multi-sided cross-section, such as a hexagonal cross-section. The bottom surface of the compression bridge member **202** bears on the top surface **205** of the post **208**. The bottom surface **214** of the post **212** bears directly on the foundation **4** in transferring compression forces from the bridge member **202** to the post **212** and thence to the foundation **4**.

Referring to FIGS. **122** and **123**, the post **204** may be a metal post **216** with a square or rectangular cross-section. The bottom surface of the compression bridge member **202** bears on the top surface **207** of the post **208**. The bottom edge surface **218** of the post **216** bears directly on the foundation **4** in transferring compression forces from the bridge member **202** to the post **216** and thence to the foundation **4**.

Referring to FIG. **124**, the post **204** may be a metal post **220** with a tapered bottom end portion **222** with a bottom surface **224** that bears directly on the foundation **4** in transferring compression forces from the bridge member **202** to the post **220** and thence to the foundation **4**.

Referring to FIGS. **125** and **126**, the post **204** may extend to an upper wall, such as the wall **5**. The post **204** extends through the top plate **14** of wall **3** and through the bottom plate **12** of wall **5**.

Referring to FIGS. **127** and **128**, the bridge member **58** is attached to the rod post **20** with a sleeve assembly **225** for transferring compression and tension forces from the bridge member **58** to the rod post **20**. The sleeve assembly **225** includes a cylindrical body **226** with an axial unthreaded opening **234** through which the rod post **20** extends. The cylindrical body **226** is disposed inside an opening **227** in the bridge member **58**. Threaded end portions **232** extend beyond the respective opposite sides of the bridge member **58** and are threaded to respective bearing plates **228**, holding the cylindrical body **226** in place. The bearing plates **228** bear on the respective opposite sides of the bridge member **58**. Nuts **24** attach the rod post **20** to the cylindrical body **226** and hence the bridge member **58**. Compression and tension forces are transferred from the bridge member **58** to the rod post **20** via the lower nut **24** and the upper nut **24**, respectively.

Referring to FIG. **129**, the sleeve assembly **225** is modified as sleeve assembly **229** where the cylindrical body **226** is provided with a threaded axial opening **238** for threading with the rod post **20**. The threaded opening **238** replaces the nuts **24** shown in FIG. **128**.

Referring to FIG. **130**, the sleeve assembly **229** is used as a coupling to join together two sections of the rod post **20** with their respective ends **240** bearing against each other. In this manner, compression forces from the upper rod post **20** are advantageously transferred directly to the lower rod post **20**.

Referring to FIG. **131**, the sleeve assembly **229** is modified as sleeve assembly **231** where the cylindrical body **226** is provided with coaxial openings **246**, **248** and **244**. The openings **246** and **244** are threaded and disposed at opposite ends of the cylindrical body **226**. The opening **248** is unthreaded and has diameter larger than the diameter of the opening **246** but smaller than the diameter of the opening **244**. The sleeve assembly **231** is used as a coupling to join together a smaller diameter threaded rod or tie rod **254** and a larger diameter threaded rod **252**. The sleeve assembly is able to transfer compression and tension forces from the bridge member **58** to the threaded rods **254** and **252**.

The larger diameter rod **252** is sized not for what is required to handle the expected tension load for the lower wall **3** but for the expected compression load to allow the rod **252** to function as a post, allowing a lesser number of studs to be used. The rod **254** may be designed only to handle tension loads, which typically require a smaller diameter rod than for compression loads.

Referring to FIG. **132**, the ends of the threaded rods **254** and **252** may engage each other inside the cylindrical body **226** at their respective ends **250**. In this manner, compression forces from the rod **254** are advantageously transferred directly to the rod **252**.

Referring to FIG. **133**, the sleeve assembly **255** may also be used for the bridge member **44**, which is made of engineered wood. The bearing plates **228** advantageously spread the compression and tension over a larger area over the underlying or overlying bridge member surface.

Referring to FIG. **134**, the bridge member **256** is the same as the bridge member **94** (FIG. **59**), except that the opening **96** is unthreaded. Nuts **24** attach the bridge member **256** to the rod post **20** for compression and tension forces transmitted by the trimmer studs **28** and the studs **6**.

Referring to FIG. **135**, the bridge member **94** is shown attached to the rod post **20** through the threaded opening **96**. Compression and tension forces are transferred from the bridge member **94** to the rod post **20** through the threaded connection of the rod post **20** to the bridge member **94** at the threaded opening **96**.

Referring to FIG. **136**, the bridge member **94** is attached to the studs **6** with screws **124**. Compression and tension forces from the wall are transferred to the bridge member **94** via the screws **124**.

Referring to FIGS. **137** and **138**, a solid metal bridge member **262** is shown attached to the rod post **20** with the nuts **24**. The bridge member **262** extends through an unthreaded opening **264**. The trimmer studs **28** hold the bridge member **262** to the wall.

Referring to FIGS. **139** and **140**, the bridge member **58** (FIG. **58**) made of solid metal is shown attached to the trimmer studs **28** and the studs **6**. The rod post **20** is threaded to the threaded opening **96** for transfer of compression and tension forces from the bridge member **92** to the rod post **20**.

Referring to FIG. **141**, the bridge member **92** is used to join together two sections of the rod post **20**. The ends of the rod posts **20** abut each other inside the opening **96** at **240**. In this manner, compression forces from the upper rod post **20** are advantageously transferred directly to the lower rod post **20**.

Referring to FIG. **142**, the bridge member **92** is modified as bridge member **266** with coaxial openings **270**, **272** and **268**. The openings **270** and **268** are threaded and disposed at opposite top and bottom of the bridge member **266**. The opening **272** is unthreaded and has diameter larger than the diameter of the opening **268** but smaller than the diameter of the opening **270**. The bridge member **266** is used as a coupling to join together a smaller diameter threaded rod **254** and a larger diameter threaded rod **252**. The bridge member **266** is able to transfer compression and tension forces the wall to the threaded rods **254** and **252**.

Referring to FIGS. **143**, **144** and **145**, the bridge member **42** (FIG. **37**) is shown installed inside the floor joist space between the top plate **14** of the wall below and the subfloor **36** of the wall above. The partly threaded hole **45** includes an unthreaded portion **276** and a threaded portion **274**. The rod post **20** is threaded to the lower bridge member **42** and the upper bridge member **42** for compression and tension forces. The lower bridge member **42** is disposed on top of the top plate **14** of the lower wall **3** with the rod post **20** extending through the lower bridge member **42**. The end of the rod post **20** extends partway into the upper bridge member **42**.

Although the rod post **20** is shown as one piece, it should be understood that it can be of two pieces, joined together inside the bridge member **42** with the hole **45** provided with additional thread opposite the threaded portion **274** or completely threaded, as shown in FIG. **67**, **68** or **158**.

Referring to FIGS. **146**, **147** and **148**, the bridge members **42** shown in FIG. **143** are replaced with the bridge members **44** made of engineered wood. Each bridge members **44** is attached to the wall by a modified sleeve assembly **281**, similar to the sleeve assembly **225** shown in FIG. **128**, with a modified cylindrical body **278** and an axial opening **285**. The opening **285** has an unthreaded portion **280** and a threaded portion **282**. The diameter of the unthreaded portion **280** is preferably larger than the diameter of the threaded portion **282** to allow the rod post **20** to extend past the threaded portion **282** as shown in FIG. **148**. Recesses **286** are cut into the upper and lower edges of the bridge members **44** for receiving the respective bearing plates **228** to make them flush with the rest of the edges.

Referring to FIG. **149**, the sleeve assembly **231** shown in FIG. **131** may be used instead of the sleeve assembly **281** shown in FIG. **147**. This is to allow the use of the larger diameter rod **252** as a post in the lower wall **3**. The larger diameter rod **252** is sized not for what is required to handle the expected tension load for the lower wall **3** but for the expected compression load to allow the rod **252** to function as a post, allowing a lesser number of studs to be used.

Referring to FIG. **150** the sleeve assembly **231** shown in FIG. **149** is modified as coupling **284** having a solid cylindrical body **288**. Threaded blind holes **292** and **290** are provided at respective ends of the cylindrical body. The diameter of the threaded blind hole **292** is preferably smaller than the diameter of the threaded blind hole **290** to allow the use of a smaller diameter rod **254** or the larger diameter rod **252**. The use of the larger diameter rod **252** advantageously allows for sizing of the rod **252** to handle compression forces as a post and lessen the number of studs to be used.

Referring to FIGS. **151**, **152**, **153** and **154**, the bridge members **44** shown in FIG. **146** are replaced with the bridge members **58**. Each bridge member **58** is attached to the wall by the sleeve assembly **225**. To accommodate the use of the nuts **24**, oversize openings **293** around the rods **20** are provided in the top plate **14** and the bottom plate **12** above. The bearing plates **228** may be modified as round bearing

plates **298** to provide a uniform distribution of the bearing area around the rod posts **20**. Since the bridge members **58** are made of sawn wood, they have less compressive strength than engineered wood. Accordingly, providing a larger bearing area underneath the round bearing plates **298** will reduce the chance of crushing the bridge members **58** due to compression and tension forces. The slots or recesses **286** allow the bearing plates **298** and the nuts **24** to be disposed above the top plate **14** and below the bottom plate **12**.

Referring to FIG. **155**, the bridge members **42** shown in FIG. **143** may be replaced with the bridge members **94** (FIG. **59**).

Referring to FIGS. **156**, **157** and **158**, the bridge members **42** may be replaced with bridge members **300** preferably made of solid metal. Each bridge member **300** is shorter than the width of the stud bay to accommodate smaller compression and tension forces. The rod post **20** extends through an opening **301** with an unthreaded portion **304** and a threaded portion **302**. The rod post **20** is threaded to the threaded portion **302**. The bridge member **300** has coaxial openings **308**, **310** and **306**. The openings **308** and **306** are threaded and disposed at opposite top and bottom of the bridge member **300**. The opening **310** is unthreaded and has diameter larger than the diameter of the opening **308** but smaller than the diameter of the opening **306**. The bridge member **300** is used as a coupling to join together a smaller diameter threaded rod **254** and a larger diameter threaded rod **252**.

Referring to FIGS. **159** and **160**, the sleeve assembly **281** (FIG. **147**) may be used outside a bridge member, depending on the expected compression and tension load for the wall. The sleeve assembly **281** is disposed within the floor joist space between the top plate **14** of the wall below and the subfloor **36** of the wall above. Since the rod post **20** is threaded to the cylindrical body **278**, the sleeve assembly **281** is able to transfer compression and tension forces from the wall to the rod post **20** via the bearing plates **228** and cylindrical body **278**. The bearing plates **228** advantageously spread the forces over the top plate **14** and subfloor **36** to reduce crushing of the wood structures.

Referring to FIGS. **161** and **162**, a cylindrical body **303** is disposed inside the floor joist space between the top plate **14** of the wall below and the subfloor **36** of the wall above. The cylindrical body **303** has an axial opening **285** with an unthreaded portion **280** and a threaded portion **282**. The diameter of the unthreaded portion **280** is preferably larger than the diameter of the threaded portion **282** to allow the rod post **20** to extend past the threaded portion **282** as shown in FIG. **162**. The top and bottom ends **305** of the cylindrical body **303** bear on the respective top plate **14** and the subfloor **36**. Since the rod post **20** is threaded to the cylindrical body **303**, the cylindrical body **303** is able to transfer compression and tension forces from the wall to the rod post **20**. Use of the cylindrical body **303** will depend on the expected compression and tension forces that will crushing of the wood structures by the bottom and top ends **305**.

Referring to FIG. **163**, the cylindrical body **303** is modified as cylindrical body **312** with coaxial openings **316**, **318** and **314**. The openings **316** and **314** are threaded and disposed at opposite ends of the cylindrical body **312**. The opening **318** is unthreaded and has diameter larger than the diameter of the opening **316** but smaller than the diameter of the opening **314**. The cylindrical body **312** is used as a coupling to join together a smaller diameter threaded rod **254** and a larger diameter threaded rod **252**. The cylindrical body **312** is able to transfer compression and tension forces from top plate **14** and subfloor **36** to the threaded rods **254** and **252**.

Referring to FIGS. **164** and **165**, the cylindrical body **226** of the sleeve assembly **225** extends across the floor joist space through openings **307** in the top plate **14**, the subfloor **36** and the bottom plate **12**. The cylindrical body **226** is attached to the top plate **14** and the bottom plate **12** with the respective bearing plates **298** threaded to the respective threaded ends **232**. The rod post **20** extends through the opening **234** and attached to the cylindrical body **226** with the nuts **24**. Compression and tension forces are transferred from the top plate **14** and the bottom plate **12** to the rod post **20** via the lower nut **24** and the upper nut **24**, respectively.

Referring to FIGS. **166** and **167**, CLT floor panels **32** are disposed between respective top plates **14** and bottom plates **12**. The rod post **20** is attached to the CLT floor panels **32** with the sleeve assembly **281** (see FIG. **147**). The cylindrical body **278** is disposed across the thickness of the CLT floor panel **32** in an opening **321**. Recesses **286** are cut into the upper and lower surfaces of the floor panel **32** for receiving the respective bearing plates **228** to make them flush with the rest of the surfaces. The lower recess **286** is larger than the actual size of the bearing plate **228** to provide room when screwing the bearing plate **228** to the threaded into the lower threaded end portion **232**. The opening **285** has an unthreaded portion **280** and a threaded portion **282**. The diameter of the unthreaded portion **280** is preferably larger than the diameter of the threaded portion **282** to allow the rod post **20** to extend into the next sleeve assembly **281** disposed in the upper CLT floor panel **32** in the upper wall **7** where the end of the rod post **20** is threaded to the threaded portion **282** of the opening **285**, similar to what is shown in FIG. **147**. The sleeve assembly **281** is able to transfer compression and tension forces from the floor panels **32** to the rod posts **20**.

Referring to FIG. **168**, the sleeve assembly **281** is modified as sleeve assembly **319** where the cylindrical body **320** is provided with coaxial openings **322**, **324** and **325**. The openings **322** and **325** are threaded and disposed at opposite ends of the cylindrical body **320**. The opening **324** is unthreaded and has a diameter smaller than the diameter of the openings **322** and **325** so that a shoulder **327** provides a stop for the ends of the rod posts **20**. The diameters of the openings **322** and **325** are preferably the same. The sleeve assembly **319** is used as a coupling to join together two sections of rod posts **20**. The sleeve assembly **319** is able to transfer compression and tension forces from the floor panel **32** to the rod posts **20**.

Referring to FIG. **169**, the sleeve assembly **231** (see FIG. **149**) may also be used. The sleeve assembly **231** allows for connecting a smaller diameter tie rod **254** for loading situations where the expected compression forces can be handled by the smaller diameter tie rod **254**. The sleeve assembly **231** is used as a coupling to join together the rod **254** to the rod post **252**. The sleeve assembly **231** is able to transfer compression and tension forces from the floor panel **32** to the rods **254** and **252**.

Referring to FIGS. **170** and **171**, a metal body such as a bearing plate **326** is used to connect the CLT floor panel **32** to the rod post **20**. The bearing plate **326** is preferably embedded in a cavity in the CLT floor panel **32** during manufacture. A threaded opening **328** is aligned with an opening **329** through the thickness of the panel **32** to allow the rod post **20** to be threaded to the bearing plate **326** to connect the rod post **20** to the bearing plate **326**. The bearing plate **326** is able to transfer compression and tension forces from the floor panel **32** to the rod post **20**.

Referring to FIGS. **172** and **173**, a metal body such as a cylindrical coupling **330** is disposed inside a cavity **336** in

the CLT floor panel **32**. The coupling **330** has a smaller diameter threaded opening **334** and a coaxial larger diameter threaded opening **332**. The openings **329** in the floor panel **32** allow the smaller diameter rod **254** to be threaded to the threaded opening **334** and the larger diameter rod **252** to the larger diameter threaded opening **332**. The cylindrical coupling **330** is embedded in the CLT floor panel **32** during manufacture. The cylindrical coupling **330** has opposite top **337** and bottom surface **339** that provide bearing surfaces for resisting compression and tension forces and transferring the same to the rods **254** and **252** through the threaded connections.

Referring to FIG. **174**, a body such as a cylindrical coupling **338** is disposed on the top plate **12**. The coupling **338** has a smaller diameter threaded opening **342** and a coaxial larger diameter threaded opening **340**. An opening **346** through the top plate **14**, the CLT floor panel **32** and the top plate **12** allow the larger diameter rod **252** to be threaded to the threaded opening **340** and the smaller diameter rod **254** to the smaller diameter threaded opening **342**. A sight hole **344** communicating with the threaded opening **340** provides a visual check on the penetration of the rod **252** into the threaded opening **340** to insure maximum thread engagement. A threaded body **343** is threaded to the rod **252** to bear against the bottom of the top plate **14**. The threaded body **343** may be a circular plate **298** such as shown in FIG. **154** or a rectangular bearing plate **228** such as shown in FIG. **160**. The cylindrical coupling **338** has a bottom surface **347** and the threaded body a top surface **349** that provide bearing surfaces for resisting compression and tension forces and transferring the same to the rods **254** and **252** through the threaded connections.

Referring to FIG. **175**, a round solid metal post **204** bears on a foundation made of a wood beam **348**. Compression forces are transferred from the post **204** to the wood beam **348** via the bottom surface **350** of the post **204**.

Referring to FIGS. **176** and **177**, a metal bearing plate **352** is disposed on the wood beam **348** for transferring compression forces from the rod post **20** to the wood beam **348**. The bearing plate **352** has a threaded opening **354** for attaching to the rod post.

Referring to FIGS. **178** and **179**, a metal bearing plate **356** is disposed on the wood beam **348** for transferring compression forces from the rod post **20** to the wood beam **348**. The bearing plate **356** has an unthreaded opening **358** for receiving an end portion of the rod post **20**. A nut **24** is attached to the end portion of the rod post **20** to hold the rod post **20** in place from compression forces. The bottom of the rod post **20** is above the wood beam **348**.

Referring to FIG. **180**, a blind hole **360** in the wood beam is provided. The end portion **362** of the rod post **20** extends into the hole **360**.

Referring to FIG. **181**, the bearing plate **352** is used. The end portion **362** of the rod post **20** extends into the blind hole **360**. The rod post **20** is threaded to the bearing plate **352** for transferring compression forces from the rod post **20** to the wood beam **348** via the bearing plate **352**.

Referring to FIGS. **182** and **183**, a metal bearing plate **364** is disposed on the wood beam **348** for transferring compressing forces from the rod post **20** to the wood beam **348**. The bearing plate **364** has an unthreaded blind hole **366** for receiving an end portion of the rod post. The bottom of the rod post **20** bears on the floor **369** of the blind hole **366** to transfer compression forces from the rod post **20** to the wood beam **348** via the bearing plate **364**.

Referring to FIG. **184**, a metal bearing plate **370** is disposed on the wood beam **348** for transferring compressing forces from the metal round post **204** to the wood beam **348**. The bottom surface **372** of the post **204** bears on the bearing plate **370**. The bearing plate **370** advantageously spreads the compression forces over a larger surface area of the wood beam **348** than the bottom surface **372** of the post without the bearing plate **370**.

Referring to FIGS. **185** and **186**, the bearing plate **352**, which is threaded to the rod post **20**, is attached to the wood beam **348** with screws **124** to advantageously allow the rod post **20** to also handle tension forces in addition to compression forces.

Referring to FIG. **187**, metal bearing plates **352** with threaded openings **354** are disposed respectively on the top surface and bottom surface of the wood beam **348**. The rod post **20** extends through an opening **353** through the wood beam **348** from the top surface to the bottom surface. The bearing plates **352** are threaded to the rod post **20** and bear on the respective top and bottom surfaces of the wood beam **348** to securely attach the rod post **20** to the wood beam **348**. The bearing plates **352** advantageously spread the compression and tension forces over a larger surface area of the wood beam **348**. The rod post **20** is threaded to the bearing plates **352** for transferring compression and tension forces from the rod post **20** to the wood beam **348** via the bearing plates **352**.

Referring to FIG. **188**, metal bearing plates **356** with unthreaded openings **358** are disposed respectively on the top and bottom of the wood beam **348**. The rod post **20** extends through an opening **353** through the wood beam **348**. The bearing plates **356** are attached to the rod post **20** with the nuts **24** and bear on the respective top and bottom surfaces of the wood beam **348** to securely attach the rod post **20** to the wood beam **348**. The bearing plates **356** advantageously spread the compression and tension forces over a larger surface area of the wood beam **348**. The nuts **24** are threaded to the rod post **20** to transfer compression and tension forces from the rod post **20** to the wood beam **348** via the bearing plates **356**.

Referring to FIGS. **189** and **190**, the nuts **24** shown in FIG. **188** may be replaced with welding **376** to attach the rod post **20** to the bearing plates **356**.

Referring to FIG. **191**, a rod post **382** includes a smaller diameter end portion **380** that extends the wood beam **348**. A circumferential shoulder **378** bears on the upper bearing plate **356**. Welding **376** attaches the lower bearing plate **356** to the end portion **380**. Compression forces on the rod post **382** are transferred to the wood beam **348** through contact between the shoulder **378** and the upper bearing plate **356**. Tension forces on the rod post **382** are transferred to the wood beam **348** through the welding **376** between the end portion **380** and the lower bearing plate **356**.

Referring to FIG. **192**, the shoulder **378** bears directly on the wood beam **348**. The smaller diameter end portion **380** is threaded to the bearing plate **352**, which bears on the bottom surface of the wood beam **348**. Compression forces on the rod post **382** are transferred to the wood beam **348** through contact between the shoulder **378** and the wood beam **348**. Tension forces on the rod post **382** are transferred to the wood beam **348** through the lower bearing plate **356** and to the wood beam **348**.

Referring to FIGS. **193**, **194**, **195** and **196**, solid metal rod post **20** extends through an opening **392** and bears on a foundation made of a steel I-beam **386** with upper and lower flanges **390** connected with web **391**. The bottom of the rod post **20** bears on the upper flange **390**, preferably centered over the web **391**. Compression forces are transferred from

the post **20** to the steel I-beam **386** via the bottom surface **388** of the post **20**. The rod post **20** is unthreaded or threaded.

Referring to FIGS. **197**, **198** and **199**, the rod post **20** is attached to the flange **390** with welding **394**. An oversize opening **396** in the bottom plate **12** allows access to the bottom end of the rod post **20** during welding. Compression forces on the rod post **20** are transferred to the steel I-beam **386** through contact with the bottom surface of the rod post **20** and welding. Tension forces on the rod post **382** are transferred to the steel I-beam **386** through the welding **394** between the rod post **20** and the steel I-beam **386**. The rod post **20** is unthreaded or threaded.

Referring to FIGS. **200**, **201** and **202**, a cylindrical body **400** with an axial opening **401** is disposed in an opening **403** in the top plate **12**. The cylindrical body **400** receives an end portion of the rod post **20**. The cylindrical body is attached to the rod post **20** with welding **398** around the opening **401**. The cylindrical body **400** is attached to the flange **390** with welding **402** at the bottom of the cylindrical body **400**. The bottom **404** of the rod post **20** may bear on the flange **390** (FIG. **201**) or be spaced a distance **406** above the flange **390** (FIG. **202**).

Referring to FIGS. **203**, **204** and **205**, the rod post **20** extends through the opening **392** into an unthreaded opening **408** in the top flange **390**. The opening **408** is preferably centered over the web **391**. The bottom surface **410** of the rod post **20** bears on the bottom of the opening **408**. The rod post **20** may be threaded (FIG. **203**) or unthreaded (FIG. **204**). The opening **408** may be a threaded opening **412** to which the threaded rod **20** is screwed (FIG. **205**) to also allow tension forces in addition to compression forces to be transferred to the steel I-beam **386**.

Referring to FIG. **206**, an oversize opening **413** allows the nut **24** to bear on the upper flange **390**. The nut **24** is threaded to the end portion of the rod post **20**. The end portion of the rod post **20** extends through the opening **413** and into the opening **408**. The bottom surface of the rod post **20** is spaced from the bottom of the opening **408**. Compression forces from the rod post **20** are transferred to the steel I-beam **386** through contact of the nut **24** with the upper flange **390** of the steel I-beam **386**.

Referring **207**, an opening or cutout **415** is provided in the web **391** below the opening **408** to accommodate the lower nut **24**. The cutout **415** communicates with the opening **408**. The cutout **415** is wider than the diameter of the opening **408** to provide a flange **417** around the opening **408**. The rod post **20** is attached to the steel I-beam **386** with the upper nut **24** and the lower nut **24** bearing on the upper flange **390**. Compression forces from the rod post **20** are transferred to the steel I-beam **386** through contact of the nut **24** with the upper flange **390** of the steel I-beam **386**. Tension forces on the rod post **20** are transferred to the steel I-beam **386** through the lower nut **24** bearing on the underside of the upper flange **390**.

Referring to FIGS. **208**, **209** and **210**, a cylindrical body **414** with an axial threaded opening **415** is disposed in the opening **403** in the top plate **12**. The cylindrical body **414** receives an end portion of the rod post **20**. The cylindrical body **414** is attached to the rod post **20** through the threaded opening **415**. The cylindrical body **414** is attached to the flange **390** with welding **416** at the bottom of the cylindrical body **414**. The bottom **418** of the rod post **20** may bear on the flange **390** (FIG. **209**) or be spaced a distance **420** above the flange **390** (FIG. **210**). Compression forces from the rod post **20** are transferred to the steel I-beam **386** through contact of the cylindrical body **414** with the upper flange **390** of the steel I-beam **386**. Tension forces on the rod post **20** are transferred to the steel I-beam **386** through the welding **416** between the cylindrical body **414** and the upper flange **390**.

It should be understood that compression plates and bridge members are provide the same function of transferring tension or compression forces from the wall to the rod post. They only differ by their thickness. Bearing plates are thinner and may be shorter than the compression plates and may be used with bridge members made of sawn lumber to spread the forces over a larger area than the bearing area of a fastener, such as a nut to connect the bridge member to the rod post, to reduce crushing the sawn lumber with the nut.

While this invention has been described as having preferred design, it is understood that it is capable of further modification, uses and/or adaptations following in general the principle of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as may be applied to the essential features set forth, and fall within the scope of the invention or the limits of the appended claims.

I claim:

1. A reinforced building wall, comprising:

a) a foundation and an anchor rod anchored to the foundation;

b) a first stud wall disposed above the foundation;

c) a cross-laminated timber (CLT) floor panel supported by the first stud wall;

d) a second stud wall disposed above the first stud wall and supported by the CLT floor panel; and

e) a rod post operably connected to the anchor rod and the CLT floor panel to transfer downward forces from the CLT floor panel to the rod post and the anchor rod to put the rod post and the anchor rod in compression.

2. The reinforced building wall as in claim **1**, wherein the rod post is operably attached to a body disposed inside the CLT floor panel.

3. The reinforced building wall as in claim **2**, wherein:

a) the body includes a central threaded opening;

b) the rod post terminates inside a first end portion of the central threaded opening; and

c) a rod is threaded to a second end portion opposite to the first end portion of the central threaded opening.

4. The reinforced building wall as in claim **3**, wherein the threaded central opening includes a larger diameter at the first end portion than at the second end portion.

5. The reinforced building wall as in claim **2**, wherein the body includes a bearing plate.

6. The reinforced building wall as in claim **2**, wherein the body includes a cylindrical body.

7. The reinforced building as in claim **2**, wherein:

a) a first bearing plate is attached to one end of the body to bear on a lower portion of the CLT floor panel;

b) a second bearing plate is attached to another end opposite to the one end of the body, the second bearing plate to bear on an upper portion of the CLT floor panel; and

c) the rod post is threaded to the body.

8. The reinforced building wall as in claim **2**, wherein the rod post extends through the body.

9. The reinforced building wall as in claim **2**, wherein the body is below a top surface and above a bottom surface of the CLT floor panel.

10. The reinforced building wall as in claim **9**, wherein the body includes a threaded opening and the rod post is threaded to the threaded opening.

11. The reinforced building wall as in claim **10**, wherein the body includes cylindrical body.

12. The reinforced building wall as in claim **10**, wherein the body includes a bearing plate.

13. The reinforced building wall as in claim **10**, wherein:

a) the rod post terminates inside one end the body; and

b) a rod is threaded to another end opposite to the one end of the body.

14. The reinforced building wall as in claim **1**, wherein:

a) the first stud wall includes a first top plate supporting the CLT floor panel;

b) the second stud wall includes a second bottom plate supported on the CLT floor panel;

c) a first body bearing on an underside of the first top plate, the first body including a first threaded opening;

d) a second body bearing on the second bottom plate, the second body including a second threaded opening; and

e) the rod post extends through the top plate, the CLT floor panel and the second bottom plate, the rod post is threaded to the first body and the second body.

15. The reinforced building wall as in claim **14**, wherein the first body includes a bearing plate.

16. The reinforced building wall as in claim **14**, wherein the second body includes a coupler.

17. The reinforced building wall as in claim **16**, wherein the coupler includes a sight hole.

18. The reinforced building wall as in claim **16**, wherein the second threaded opening is multi-diameter.

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